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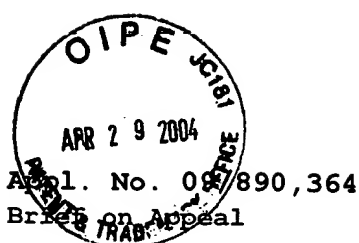
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By:

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IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

Appl. No.: 09/890,364

Applicant(s): Paulus Cornelius Duineveld,
et al.

Filed: July 30, 2001

Title: ORGANIC ELECTROLUMINESCENT DEVICE AND
A METHOD OF MANUFACTURING THEREOF

TC/A.U.: 2800/2879

Examiner: S. Leurig

Atty. Docket: PHN-17,755

BRIEF ON APPEAL BEFORE THE BOARD OF PATENT APPEALS AND
INTERFERENCES

Honorable Assistant Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In connection with the Notice of Appeal filed on January
27, 2004, Applicants provide the following Brief on Appeal in
triplicate in the above captioned application.

04/30/2004 SDIRETA1 00000131 500238 09890364

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1. Real Party in Interest

The real party in interest as assignee of the entire right and title to the invention described in the present application is Philips Electronics North America Corporation having an address at 1251 Avenue of the Americas, New York, NY 10020.

2. Related Appeals and Interferences

There are no known related appeals or interferences at this time.

3. Status of the Claims

Claims 1-10 are pending and have been twice rejected. Rejected claims 1-10 are duplicated in Appendix I.

4. Status of Amendments

A Final Office Action on the merits was mailed on October 27, 2003. In response thereto, an Amendment and/or Response under 37 C.F.R. § 116 was filed on December 29, 2003. An Advisory Action was mailed on March 1, 2004. The Advisory Action indicates that the request for reconsideration of December 29, 2003 would be entered for the purposes of Appeal.

5. Summary

According to an embodiment, an organic electroluminescent device 1 having at least one electroluminescent element (e.g., 10) includes: a first and a second electrode (6) and, disposed therebetween, an organic electroluminescent layer (5) provided in accordance with a desired pattern and obtained from a fluid layer. The device (1) further having a relief pattern (7) for containing the fluid layer from which the organic electroluminescent layer (5) provided in accordance with the

desired pattern is obtained. The electroluminescent layer (5) is substantially uniform in thickness to the extent that the proportion of the organic electroluminescent layer (5) having a thickness within 20 % of the minimum thickness of the organic electroluminescent layer (5) or the proportion of the organic electroluminescent layer (5) having a thickness within 20 % of the maximum thickness of the organic electroluminescent layer (5), is at least 0.55 and less than 1.0.

6. Issues on Appeal

I. The first issue on Appeal is whether claims 1-10 are properly rejected under 35 U.S.C. § 112 ¶1 as failing to comply with the written description requirement.

II. The second issue on Appeal is whether claims 1-6, and 9-10 are properly rejected under 35 U.S.C. 103(a) as being unpatentable over *Nagayama, et al.* (EP 0 732 868 A1) in view of *Illegems, et al.* (U.S. Patent No. 6,208,074).

III. The third issue on Appeal is whether claim 7 is properly rejected in view of and *Nagayama, et al.* (EP 0 732 868 A1) in view of *Illegems, et al.* (U.S. Patent No. 6,208,074) further in view of *Kobayashi, et al.* (U.S. Patent 6,388,377 B1);

IV. The fourth issue on Appeal is whether claim 8 is properly rejected in view of *Nagayama, et al.*, *Illegems, et al.*, *Kobayashi, et al.* and *Speakman* (U.S. 6,503,831).

7. Grouping of Claims

Group I: Claims 1-6 and 9-10 stand or fall together.

Group II: Claims 7 stands or falls alone.

Group III: Claim 8 stands or falls alone.

8. Argument

I. The first issue on appeal is the propriety of the rejection of claims 1-10 under 35 U.S.C. § 112 ¶1.

35 U.S.C. § 112 ¶1 requires that "...the specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same..."

Independent claims 1 and 5, as amended in the Response of August 20, 2003, and the claims that depend directly or indirectly therefrom, feature:

"...the electroluminescent layer is substantially uniform in thickness to the extent that the proportion of the organic electroluminescent layer having a thickness within 20 % of the minimum thickness of the organic electroluminescent layer or the proportion of the organic electroluminescent layer having a thickness within 20 % of the maximum thickness of the organic electroluminescent layer, is at least 0.55 and less than 1.0."

The Office asserts that because the application as filed does not require that the uniformity be less than perfect (i.e., uniformity of less than 1.0), that the inventors did not have possession of the claimed invention. In short, the Office asserts that the referenced feature of claims 1-10 are unsupported in the filed application. Applicants respectfully traverse this assertion for at least the following reasons.

It is well established that in order to properly comply with 35 U.S.C. § 112 ¶1 "...it is necessary to reasonably

convey to the artisan that the inventor had possession at the time of the later claimed subject matter." *Ralston Purina Company v. Far-Mar-Co., Inc.* 227 USPQ 177 (1985).

First, it is noted that the present application neither requires that the uniformity be perfect (1.0) or imperfect (less than 1.0). Rather, the disclosure would be understood by one of ordinary skill in the art to convey that while perfect uniformity is ideal in improving service lifetime, it is not necessary. To this end, upon review of the application as filed, one of ordinary skill in the art would recognize that it is useful to provide an electroluminescent device and method of fabrication such a device having a proportion of the organic electroluminescent layer having a thickness within 20 % of the minimum thickness of the organic electroluminescent layer or the proportion of the organic electroluminescent layer having a thickness within 20 % of the maximum thickness of the organic electroluminescent layer, **is at least 0.55.**

According to example embodiments described in the filed application, a plethora of quantitative values of the referenced proportions are given to improve the service lifetime. For example, the filed application cites proportions of at least 0.60, at least 0.7, and at least 0.75. Furthermore, the application notes that it is beneficial to the service lifetime that these proportions be 0.9 or 0.95. The disclosure also recognizes that the proportion is a measure of the uniformity of the thickness of the layer, and if the proportion is 1.0, the electroluminescent is perfectly uniform in thickness. (Kindly refer to page 2, lines 5-24 for support for the present assertions.) From at least these quantitative values for the uniformity, it is respectfully asserted that one of ordinary skill in the art would recognize than an improved

service lifetime could be realized with less than perfect uniformity.

Accordingly, it is respectfully submitted that the features of the application as filed, and as referenced above, set the floor of the proportion for improved service life at 0.55. The application notes the increasing preference for a greater proportion, citing the preference for the proportion to be 0.95. Moreover, the application recognizes that perfect uniformity is 1.0. Clearly, the perfect uniformity may be useful in improving service lifetime, it is not essential; and less than perfect uniformity is clearly beneficial to improving the service lifetime.

As such, it is respectfully submitted that according to the application as filed, the proportion should be greater than 0.55 for improved service lifetime, but cannot be more than 1.0 by mathematical definition. Thus, it is respectfully submitted that within the context of the application as filed, one skilled in the art would readily ascertain that the inventors had grasped that a proportion that is greater than 0.55 is needed, but also that a proportion that is less than 1.0 is beneficial according to the teachings of the application as filed.

For at least the reasons set forth above, it is respectfully submitted that the rejection of claims 1-10 under 35 U.S.C. § 112 ¶1 is improper and should be withdrawn.

II-IV. The second through fourth issues on appeal is the propriety of the rejection of claims 1-6 and 9-10 under 35 U.S.C. § 103(a) as being obvious in view of *Nagayama, et al.* (EP 0732868 A1) and *Illegems, et al.* (U.S. 6,208,074 B1); claim 7 in view of these references and further in view of *Kobayashi,*

et al. (U.S. Patent 6,388,377 B1); and claim 8 in view of Nagayama, et al., *Illegems*, et al., Kobayashi, et al. and Speakman (U.S. 6,503,831).

For at least the reasons that follow, it is respectfully submitted that these rejections are improper and should be withdrawn.

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is a teaching, suggestion or motivation to do so found in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine* 5 USPQ 2d 1596 (1988) However, hindsight is never an appropriate motivation for combining references and/or the requisite knowledge available to one having ordinary skill in the art. To this end, relying upon hindsight knowledge of applicants' disclosure when the prior art does not teach nor suggest such knowledge results in the use of the invention as a template for its own reconstruction. This is wholly improper in the determination of patentability. *Sensonics Inc. v Aerosonics Corp.*, USPQ 2d 1551-1554 (1996).

An initial requirement of a proper rejection under 35 U.S.C. § 103(a) is that **all** of the claimed elements be found in the applied art. If a **single** claimed element is not found in the applied art, a prima facie case of obviousness cannot be properly established.

First, it is noted that the Office Action of October 27, 2003, does not provide the requisite teaching, suggestion or motivation from the applied art to combine the references of Nagayama, et al. and *Illegems*, et al. Rather, the Office Action states that ``It is well-known in the art that an

organic electroluminescent layer with a uniform thickness has more consistent luminescence than one of widely varying thickness." (Kindly refer to page 5 of the Office Action of October 27, 2003). At least because the supplied motivation is not from the confines of the applied art, it cannot provide the requisite motivation to combine the applied references. For at least this reason, this rejection is improper and should be withdrawn.

It is respectfully submitted that independent claims 1 and 5 are patentable over the applied references, at least because the applied references neither teach nor suggest the at least the patentable feature that an *"electroluminescent layer is substantially uniform in thickness to the extent that the proportion of the organic electroluminescent layer having a thickness within 20 % of the minimum thickness of the organic electroluminescent layer or the proportion of the organic electroluminescent layer having a thickness within 20 % of the maximum thickness of the organic electroluminescent layer, is at least 0.55, and less than 1.0."*

The reference to Nagayama, et al. lacks at least the limitations of claims 1 and 5 that have been captioned above. In fact the Office recognizes that the reference to Nagayama, et al. lacks the disclosure of certain referenced limitations. (Kindly refer to page 5 of the Office Action of October 27, 2003).

The Office relies on the reference to Illegems, et al. that teaches of spin coating an organic EL layer with a perfect uniform thickness. However, Applicants respectfully submit that Illegems, et al. does not disclose the referenced range of the thickness of the organic electroluminescent layer featured

in claims 1 and 5. To this end, claims 1 and 5 each feature a proportion indicative of the uniformity, where 1.0 equates to a perfectly uniform thickness. The range of claim 1 is greater than 0.55 and less than 1.0. As such, claims 1 and 5 include proportions of 0.65, 0.75, 0.95, for example. However, these are not layers of perfectly uniform thickness. But the reference to *Illegems, et al.* is drawn to a perfectly uniform layer. As such, the reference to *Illegems, et al.* does not teach layers having the proportions featured in claims 1 and 5.

The Office further asserts that any layer of perfectly uniform thickness inherently fulfills the features of claims 1 and 5 referenced above. (Kindly refer to page 5 of the Office Action of October 27, 2003). Applicants have asserted that the reference to *Illegems, et al.* is lacking of certain features of claims 1 and 5.

It is well-established that to establish inherency, extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be recognized by persons of ordinary skill in the art. However, inherency may not be established by possibilities and probabilities. The mere fact that a certain thing result may result from a given set of circumstances is not sufficient.

As asserted above, the reference to *Illegems, et al.* is drawn to forming layers of perfectly uniform thickness. Therefore, layers of less than perfectly uniform thickness are not described, and certainly are not a result of the methods of the reference. As such, it is respectfully asserted that these layers do not necessarily follow from, and are thus not inherent to *Illegems, et al.* In view of this assertion, Applicants respectfully request extrinsic evidence supporting

the Office's position. If the assertion of inherency is based on the personal knowledge of the Examiner, and affidavit under 37 C.F.R. 1.104(d) (2) is respectfully requested. In absence of either the extrinsic evidence or the affidavit the claim of inherency should be withdrawn.

Applicants maintain the assertions of the impropriety of the combination of *Nagayama, et al.* and *Illegems, et al.* set forth in a previous response. Accordingly, while no way conceding as to the propriety of the rejections set forth in the Office Actions, or the propriety of the combination of the applied references set forth in the Office Actions, Applicants respectfully submit that the applied art lacks a teaching of at least one of the features of claims 1 and 5.

For at least the reasons set forth above, it is respectfully submitted that the Office has failed to establish a *prima facie* case of obviousness under 35 U.S.C. under 35 U.S.C. § 103(a). As such, claims 1 and 5, and the claims that depend therefrom are allowable over the applied art. Allowance is earnestly solicited.

Conclusion

In view of the foregoing, applicant(s) respectfully request(s): the withdrawal of all objections and rejections of record; the allowance of all the pending claims; and the holding of the application in condition for allowance. If any points remain in issue that may best be resolved through a personal or telephonic interview, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and further replies to charge payment or credit any overpayment to Deposit Account Number 50-0238 for

any additional fees under 37 C.F.R. §1.16 or under 37 C.F.R. §1.17.

In the event that there are any outstanding matters remaining in the present application, the Examiner is invited to contact William S. Francos, Esq. (Reg. No. 38,456) at (610) 375-3513 to discuss these matters.

Respectfully submitted on behalf of:
Philips Electronics North America Corp.

A handwritten signature in black ink, appearing to read 'Will S. Francos', followed by a long horizontal line extending to the right.

by: William S. Francos (Reg. No. 38,456)

Date: April 26, 2004
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APPENDIX I

Claims on Appeal:

1. An organic electroluminescent device having at least one electroluminescent element comprising a first and a second electrode and, disposed therebetween, an organic electroluminescent layer provided in accordance with a desired pattern and obtained from a fluid layer, the device further having a relief pattern for containing the fluid layer from which the organic electroluminescent layer provided in accordance with the desired pattern is obtained, characterized in that the electroluminescent layer is substantially uniform in thickness to the extent that the proportion of the organic electroluminescent layer having a thickness within 20 % of the minimum thickness of the organic electroluminescent layer or the proportion of the organic electroluminescent layer having a thickness within 20 % of the maximum thickness of the organic electroluminescent layer, is at least 0.55 and less than 1.0.
2. An organic electroluminescent device as claimed in claim 1, characterized in that the relief pattern or a part thereof has a transverse profile having an overhanging section rendering the relief pattern suitable for patterning the second electrode.
3. An organic electroluminescent device as claimed in claim 2, characterized in that the relief pattern is a composite relief pattern of a first relief pattern for containing the fluid layer and a second relief pattern having an overhanging section rendering the second relief pattern suitable for patterning the second electrode.

4. An organic electroluminescent device as claimed in claim 1, characterized in that the organic electroluminescent device comprises a plurality of independently addressable electroluminescent elements.

5. A method of manufacturing an organic electroluminescent device having at least one electroluminescent element, said method comprising the steps of:

- a) providing a first electrode,
- b) providing a relief pattern for containing a fluid layer from which an organic electroluminescent layer provided in accordance with a desired pattern is obtainable,
- c) depositing a fluid layer contained by the relief pattern,
- d) obtaining, from the fluid layer, the organic electroluminescent layer provided in accordance with the desired pattern, wherein the relief pattern and the fluid layer mutually interact such that the electroluminescent layer is substantially uniform in thickness to the extent that the proportion of the organic electroluminescent layer having a thickness within 20 % of the minimum thickness of the organic electroluminescent layer or the proportion of the organic electroluminescent layer having a thickness within 20 % of the maximum thickness of the organic electroluminescent layer, is at least 0.55 and less than 1.0, and
- e) providing, on the organic electroluminescent layer, a second electrode.

6. A method as claimed in claim 5, characterized in that the relief pattern has a height selected such that, while reducing the volume of the fluid layer during the execution of step d),

the fluid layer gels when the fluid surface of the fluid layer is approximately level with the top of the relief pattern.

7. A method as claimed in claim 5, characterized in that the fluid layer is selectively deposited by means of ink-jet printing.

8. A method as claimed in claim 5, characterized in that the fluid layer is selectively deposited by means of dispensing a continuous jet of the fluid.

9. A method as claimed in claim 5, characterized in that the fluid layer is deposited by means of spin-coating.

10. A method as claimed in claim 9, characterized in that the relief pattern has a height of 3 to 5 μm .

APPENDIX II
References Relied Upon



(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

18.09.1996 Bulletin 1996/38

(51) Int. Cl.⁶: H05B 33/12

(21) Application number: 96103890.8

(22) Date of filing: 12.03.1996

(84) Designated Contracting States:
DE FR GB(30) Priority: 13.03.1995 JP 53011/95
10.11.1995 JP 293107/95(71) Applicant: PIONEER ELECTRONIC
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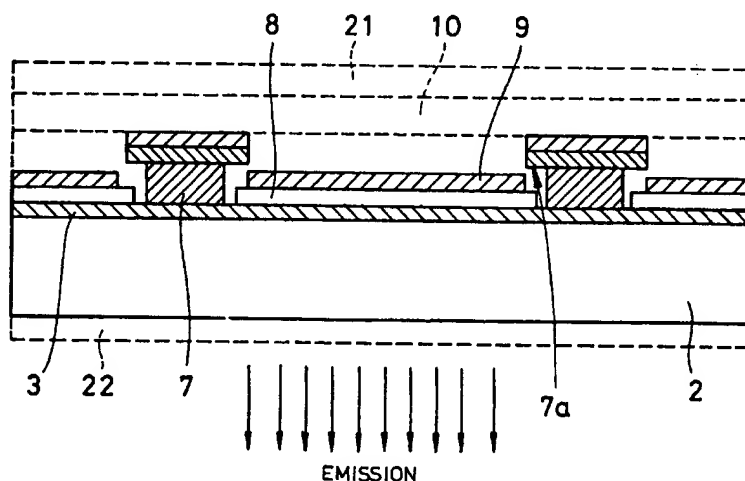
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(54) Organic electroluminescent display panel and method for manufacturing the same

(57) An organic electroluminescent display panel having a plurality of emitting portions includes; a substrate (2) on which a plurality of first display electrodes (3) corresponding to emitting portions are formed; electrical insulation ramparts (7) projecting from the substrate (2) for exposing at least portions of the first display electrodes (3) respectively; organic function layers (8) each including at least one organic electrolumi-

nescent medium formed on exposed portions of the first display electrodes (3); second display electrodes (9) formed on the organic function layers (8); and each electrical insulation rampart (7) having an overhanging portion (7a) projecting in a direction parallel to the substrate (2). The cathodes are patterned automatically without use of the photolithography.

FIG. 3



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an organic electroluminescent display panel used in a display apparatus and comprising a plurality of organic electroluminescent elements (also referred to herein as EL elements) each including an emitting layer made of an organic compound material, which utilizes an electroluminescence phenomenon that is the emission of light resulting from injection of an electric current to the emitting layer. More particularly, it is related to a full color display device comprising a matrix of the EL elements.

2. Description of the Related Art

Generally, the formations of the cathode and the organic function layers of EL media in the organic EL element are difficult in a micro-patterning art, since there are the low levels in durabilities of heat resistance (100°C or less), wet-proof and solvent-resisting of the organic EL media used for the carrier injection layers, the emitting layer or the like in the function layers. If the ordinary photolithography patterning is utilized for the formation of such function layers of the organic EL element, the solvent in the photoresist infiltrates into the function layers of the EL element to be damaged, and the organic EL element is damaged during the photoresist baking with a high temperature atmosphere, and further, the development solution or etching liquid for the photoresist layer also intrudes into the organic EL element to be damaged. Even plasma in the dry-etching for the photoresist layer damages the organic function layers of the EL element. These damages cause the deterioration in the performance of the organic EL element and emission properties. This is a serious problem.

Alternatively, there is a vacuum deposit patterning by using a shadow mask to form the cathode and the organic function layers of the organic EL element. In this case, there are many problems in that the mask comes into contact with a substrate on which the organic function layers are formed. That is, the leakage of the vapor of organic EL media occurs between the mask and the substrate due to incomplete contact thereof. Otherwise, the shadow mask is compulsorily, sealingly put into contact with the substrate. In this case, the organic EL medium is damaged due to the contact of the forced mask during the EL medium deposition, and further the cathode to be deposited is deformed by the mask to be short-circuited to the anode made of indium tin oxide (referred to herein as ITO) previously formed on the substrate. This direct contact of the mask and the substrate further causes deformities of the mask with precise fine patterns such as stripe cathode patterns because of insufficient strength of the mask with such

stripe openings. Therefore, it is very difficult to form precise fine patterns for the cathode and the organic function layers of the organic EL element.

As full color display devices, there have been known emitting devices as shown in Japanese Patent Kokai Nos. 2-66873, 5-275172, 5-258859 and 5-258860 the latter of three corresponding to U. S Patent Applications Serial Nos. 814512, 814163 and 814553 respectively. This each full color display device comprises a plurality of emitting pixels existing at intersections of lines and rows of matrix electrodes.

In the emitting device, the pixels are formed on a common transparent substrate with electrical insulation. The line electrodes made of transparent material are formed on the substrate and spaced from one another. This first transparent electrodes connect the adjacent pixels. Organic EL media are formed on the first electrodes and the substrate. The pixels include the second electrodes of row formed on the organic EL media respectively and spaced from one another. The second electrodes of row extends perpendicular to the first electrodes and connect the adjacent pixels respectively. In the emitting device, there is employed a simple matrix structure that the first and second electrodes sandwich the organic EL media at the intersections thereof.

Japanese Patent Kokai No. 2-66873 discloses a technology to avoid the forgoing problem of the infiltration of the photoresist solvent into the EL medium layer, that is, the photoresist comprising a specific solvent non-melting the organic EL medium is used in the photolithography patterning, and then the cathode pattern is etched by a dilute sulfuric acid to form the cathode. However, such an etching step is a problem in that the dilute sulfuric acid damages the previously formed organic EL medium layers on the substrate.

In the technology disclosed in Japanese Patent Kokai Nos. 5-275172, 5-258859 and 5-258860, such an emitting device is manufactured as follows: Straight higher walls with a height of several or tens micrometers as masks are previously formed on the substrate. The second electrodes and the organic EL medium thin films are vacuum-deposited by using such higher wall masks in such a manner that a predetermined organic EL medium vapor flow is provided in only one slanting direction to the substrate and partially and selectively shielded by the higher wall masks.

However, such a method restricts the flexible layout of pattern of pixels within a stripe shapes, since the wall masks must be formed perpendicular to the only one slanting direction of the organic EL medium vapor flow. Therefore, it is impossible to form a pixel pattern with a delta arrangement RGB in the panel nor any display panel with a bent or meandered cathode pattern.

Further, it is still difficult to form such higher wall masks on the substrate when fine pixels and patterns are fabricated for the full-color display panel, i.e., in detail it is very difficult to form the higher wall mask having a high aspect ratio (height/bottom) in its cross-section. Even if such higher wall masks are formed on the

substrate, the strength of the wall will be low and the reliability in the performances and shapes of the resulting second electrodes and organic EL media films will be low. In addition, such a manufacture of the emitting device invites a complicated processing because of the slanting vapor flow deposition in one direction with a low precision.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made to solve such a problem in view of the forgoing status. An object of the invention is to provide an organic electroluminescent display panel and method for manufacturing the same which are capable of being manufactured with a freely flexible patterning without deterioration of the organic function layer, cathode and other elements.

In accordance with a first aspect of the present invention, an organic EL display panel having a plurality of emitting portions comprises;

a substrate on which a plurality of first display electrodes corresponding to emitting portions are formed;

electrical insulation ramparts projecting from the substrate for exposing at least portions of the first display electrodes respectively;

organic function layers each including at least one organic electroluminescent medium formed on exposed portions of the first display electrodes;

second display electrodes formed on the organic function layers; and

each electrical insulation rampart having an overhanging portion projecting in a direction parallel to the substrate preferably at an upper.

This organic EL display panel further comprises an insulative layer formed on portions of the first display electrodes to be under said overhanging portion and/or edges of the exposed portions of the first display electrodes, whereby the short-circuit between the first and the second display electrodes is prevented.

The forgoing organic EL display panel further comprises an insulative sealing film entirely formed on the first display electrode, the organic function layers and the second display electrode. At least the second display electrode is covered as a whole with the insulative sealing film, whereby the deterioration of the EL display panel is prevented.

In the forgoing organic EL display panel, said first and the second display electrodes are formed as stripes respectively, and each first display electrode is arranged perpendicular to each second display electrode.

In the forgoing organic EL display panel, the substrate and said first display electrode are transparent, and each second display electrode has a metallic luster, otherwise the organic EL display panel further comprises a reflective film formed on the second display electrode preferably.

In another embodiment of the organic EL display panel of the invention, when each of the second display

electrodes is transparent, said first display electrode has a metallic luster, otherwise the organic EL display panel further comprises a reflective film formed on the first display electrode at the outer-side.

In accordance with a second aspect of the present invention, a method for manufacturing an organic EL display panel having a plurality of emitting portions comprises the steps of;

forming a plurality of first display electrodes corresponding to emitting portions on a substrate as a patterning step;

forming, on the substrate, electrically insulative ramparts for exposing at least portions of the first display electrodes and protruding from the substrate as a rampart formation step, said each electrical insulation rampart having an overhanging portion projecting in a direction parallel to the substrate preferably at an upper;

depositing organic electroluminescent media onto exposed portions of the first display electrodes respectively, thereby forming a plurality of organic function layers each including at least one organic electroluminescent medium on the first display electrodes; and

forming a plurality of second display electrodes formed on the organic function layers.

In this method for manufacturing an organic EL display panel, said rampart formation step further comprises preferably the steps of;

forming entirely a rampart material layer on said substrate;

forming a photo mask with a predetermined pattern openings on the rampart material layer;

etching the rampart material layer through the openings of the photo mask by using a dry-etching or wet-etching, thereby forming the ramparts having said overhanging portions.

In the forgoing method for manufacturing an organic EL display panel, the organic electroluminescent media depositing step further comprises preferably the steps of;

putting a shadow mask onto top surfaces of the ramparts, the shadow mask having a plurality of openings corresponding to the exposed portions of the first display electrodes, while aligning the openings to the first display electrodes respectively;

depositing organic electroluminescent media through the openings onto the first display electrodes between the ramparts respectively; and

repeating the mask putting and aligning step and the media depositing step in such a manner of that the shadow mask is shifted to an adjacent portion where the openings aligned to adjacent other first display electrodes, whereby enabling a high efficient manufacturing.

In this way, since the rampart protects the organic function layer during the formation thereof, there is decrease of damage of the organic function layer due to the shadow mask put thereon, even if there is performed a direct contact onto the rampart of the mask with insufficient strength and precise fine patterns such as stripe patterns. In addition, the use of the rampart

and the shadow mask makes a sure separation of RGB organic function layers and shares the coatings of RGB organic media at a high precision.

Moreover, according to the present invention, the manufacture of the organic EL display panel further comprises preferably;

between said patterning step for said first display electrode and said rampart formation step,

forming insulative layers on portions of the first display electrodes to be under said overhanging portion and/or edges of the exposed portions of the first display electrodes, the insulative layer formed at least portions of the first display electrodes to be under said overhanging portion and/or edges of the exposed portions of the first display electrodes surely prevents the short-circuit between said first and the second display electrode.

Further, the forgoing method for manufacturing an organic EL display panel according to the present invention further comprises preferably the steps of;

after forming step of the second display electrode,

forming entirely an insulative sealing film on at least of the second display electrodes, so that the insulative sealing film formed on the first display electrode, said organic function layers and said second display electrode prevents any increasing of non-emitting portions caused by the deterioration in EL media of the organic EL display panel.

Other and further features, advantages and benefits of the invention will become apparent in the following description taken in conjunction with the following drawings. It is to be understood that the foregoing general description and following detailed description are exemplary and explanatory but are not to be restrictive of the invention. The accompanying drawings which are incorporated in and constitute a part of this invention and, together with the description, serve to explain the principles of the invention in general terms. Like numerals refer to like parts throughout the disclosure.

The above set forth and other features of the invention are made more apparent in the ensuing Detailed Description of the Invention when read in conjunction with the attached Drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a partially enlarged simplified plan view of an organic EL display panel according to the present invention;

Fig. 2 is a partially enlarged perspective view of an organic EL display panel according to the present invention;

Fig. 3 is an enlarged cross-section view of an organic EL display panel according to the present invention;

Fig. 4 is a perspective view of the substrate carrying electrodes in the organic EL display panel according to the present invention;

Figs. 5A to 5C are cross-section views showing substrates in a process for manufacturing an organic EL display panel according to the present invention;

Figs. 6A and 6B are enlarged cross-section views each showing a rampart on the substrate in a process for manufacturing an organic EL display panel according to the present invention;

Figs. 7A to 7H are enlarged cross-section views each showing a rampart on the substrate in an organic EL display panel according to the present invention;

Figs. 8A to 8D are cross-section views showing substrates in a process for manufacturing an organic EL display panel according to the present invention;

Figs. 9A to 9C are cross-section views showing substrates in a process of a first embodiment for manufacturing an organic EL display panel according to the present invention;

Fig. 10 is a scanning electron microphotograph showing a rampart on the substrate in the first embodiment of an organic EL display panel according to the present invention;

Fig. 11 is a scanning electron microphotograph showing an organic function layer and an Al electrode adjacent to a rampart on the substrate in the first embodiment of an organic EL display panel according to the present invention;

Fig. 12 is a scanning electron microphotograph showing a rampart on the substrate in a second embodiment of an organic EL display panel according to the present invention;

Fig. 13 is an enlarged cross-section view of a third embodiment of an organic EL display panel according to the present invention;

Figs. 14A to 14D are cross-section views showing substrates in a process of a fourth embodiment for manufacturing an organic EL display panel according to the present invention;

Fig. 15 is a partially enlarged plan view of the substrate in the fourth embodiment for manufacturing an organic EL display panel according to the present invention;

Fig. 16 is a cross-section view of a portion taken in line AA of Fig. 15;

Fig. 17 is a partially enlarged plan view of the substrate in the fourth embodiment for manufacturing an organic EL display panel according to the present invention;

Fig. 18 is a cross-section view of a portion taken in line AA of Fig. 17;

Fig. 19 is a partially enlarged plan view of the substrate in the fourth embodiment for manufacturing an organic EL display panel according to the present invention;

Fig. 20 is a schematic diagrams showing an arrangement of the substrate and a vapor source in the fourth embodiment for manufacturing an

organic EL display panel according to the present invention;

Fig. 21 is a cross-section view showing a substrate in a process of a fifth embodiment for manufacturing an organic EL display panel according to the present invention; and

Figs. 22 to 25 are enlarged cross-section views each showing a rampart and adjacent thereto on the substrate in a process of the fifth embodiment for manufacturing an organic EL display panel according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments according to the present invention will be described in more detail with reference to the accompanying drawings.

Fig. 1 shows a partially enlarged simplified plan view of an organic EL display panel of an embodiment which is provided with a plurality of emitting pixels 1 of matrix each having emitting portions for red (R), green (G) and blue (B) lights in order to display an image. This is seen through the substrate of the panel from the outside thereof. In addition, the organic EL display panel may be formed as a monochrome display panel comprising a single color emitting portions instead of RGB emitting portions.

Fig. 2 shows a further enlarged perspective view of the backside of the panel in which the substrate 2 carries a plurality of first display electrodes or lines 3 arranged parallel to one another as stripes in a coplanar surface thereof.

Moreover, a plurality of ramparts 7 made of an electrical insulation material are formed on the substrate 2 so as to be arranged perpendicular to the first display electrode lines 3 and apart from each other, as shown in Figs. 2 and 3. The electrical insulation ramparts 7 project from or stand on the substrate 2 and expose at least portions of the first display electrodes 3 respectively.

Each electrical insulation rampart 7 has overhanging portions 7a projecting in a direction parallel to the substrate at an upper thereof. The overhanging portion 7a is formed along the extending edge of the rampart 7.

Between the ramparts 7, organic function layers 8 including at least one organic electroluminescent medium or compound are formed and arranged over the exposed portions of the first display electrodes 3. The organic function layer 8 includes three organic EL media thin films e.g., an organic hole transport layer, an organic emitting layer and an organic electron transport layer as a three-layer structure. The organic function layer 8 may alternatively include a two-layer structure comprising an organic hole transport layer and an organic emitting layer.

A second display electrodes 9 are formed on the organic function layers 8 of the organic electroluminescent medium respectively along the extending direction.

In this way, the intersections of the first and second display electrode lines sandwiching the organic function layers correspond to light emitting portions respectively in the organic EL display panel of a simple matrix type.

On the second display electrode 9 of the panel, a protective film 10 or a protective substrate is formed preferably. In this organic EL display panel, the substrate and the first display electrodes are light transmissible, and thus the light emission radiates from the substrate. Therefore, as shown in dot lines in Fig. 3, a reflecting layer 21 may be preferably formed on the protective film 10 in order to improve the emitting efficiency. In contrast, the second display electrode may be made of a transparent material so as to emit light from the second display electrode in another embodiment of an organic EL display panel. In this case, another reflecting layer 22 may be preferably formed on the substrate 2 in order to improve the emitting efficiency.

A process for manufacturing the organic EL display panel is now described.

In a patterning step of the process, as shown in Fig. 4, a plurality of first display electrodes 3 of a stripe shape of made a transparent conductive material such as indium tin oxide (ITO) are formed parallel to each other on a transparent substrate 2 of glass by using a photolithography technology (e.g., 0.3 mm pitch, 0.28 mm width and 0.2 micrometers thickness).

Next, by using a spin-coating method in the rampart formation step, the first display electrodes 3 on the substrate 2 are entirely covered with a rampart material such as non-photosensitive polyimide 70 as a rampart layer up to a 3 micrometers thickness. Then second rampart material such as SiO_2 71 for the overhanging portion is entirely formed on the rampart layer of polyimide 70 by using a sputtering method up to a 0.5 micrometers thickness.

Next, as shown in Fig. 5A, the SiO_2 layer 71 is spin-coated with a photoresist as a mask layer up to one micrometer thickness, and then the mask 72 of photoresist each having a 20 micrometers width is formed by using an ordinary photolithography, so that the photoresist pattern for ramparts is formed.

Subsequently, as shown in Fig. 5B, the SiO_2 layer 71 is selectively etched via openings of the mask 72 by a reactive-ion etching method so as to be the same photoresist pattern of ramparts, so that the upper portions to be overhanging portions are formed. In this reactive-ion etching, the etching gas of CF_4 is mainly used at the gas flow of 100 SCCM under the conditions of a 100 W RF power for 10 minutes for the purpose of completion of the etching.

After that, as shown in Fig. 5C, the polyimide layer 70 is also selectively etched by using a dry-etching or wet-etching method, so that the body 70 of the rampart and overhanging portion 7a projecting in a direction parallel to the substrate at the top are formed. In this way, the rampart 7 consists of the body 70 of polyimide and the overhanging portion 71 of SiO_2 with a T-shaped cross-section as a whole. The height of the T-shaped

cross-section rampart 7 from the substrate is not restricted as far as it does not provide any electric short-circuit between the individual ITO anode 3 and the individual second display electrode or cathode 9 which will be formed in the later process. Concretely, the height of the rampart 7 preferably ranges from one micrometer to 10 micrometers. In addition, the width of the overhanging portion 7a protruding from the body side of the T-shaped rampart 7 is sufficiently one micrometer or more, and the thickness of the overhanging portion is sufficiently 0.2 micrometer or more as far as they do not provide any electric short-circuit of the electrodes similarly.

This T-shaped cross-section rampart 7 is formed through the reactive-ion etching as shown in Figs. 6A and 6B in detail. First, the polyimide layer 70 is dry-etched by an O_2 gas perpendicular to the substrate without any undercut (anisotropic etching) as shown in Fig. 6A. After that, the polyimide layer 70 is wet-etched by an alkali solution for approximately 30 seconds so that the wall side 70a of the rampart body of polyimide 70 is isotropically etched as shown in Fig. 6B. Fig. 7A shows the T-shaped cross-section of the rampart 7 resulting from this two-stage etching.

Alternatively, in another etching method for engraving the polyimide layer 70, the polyimide layer 70 is isotropically wet-etched merely by an alkali solution with a pertinent concentration for 1 to 2 minutes without the previous anisotropic etching, so that SiO_2 layer 71 services as a mask for etching of the polyimide layer 70 and then undercut shapes of sidewalls of polyimide are obtained because of a isotropically wet-etching, as shown in Fig. 7B.

The so-called polyimides stated above includes a precursor which is a previous substance before imidization such as aromatic. Such a precursor is heated up to approximately $300^\circ C$ after casted as shown in Fig. 5C, so that imidization is complete to cause a thermally stable polyimide. The casted aromatic precursor may be used as it is as far as it becomes integrity without any inconvenience. Alternatively, instead of polyimide and SiO_2 , pertinent materials disintegrated during the first or second-stage etching may be used for the rampart body of the upper and the overhanging portion of the lower respectively. The electric insulative materials having shape strength of the rampart even before the formation of the organic function layer also may be used for them.

Figs. 7C to 7H show variations of cross-sections of the rampart instead of two-layer structure above mentioned. The reverse tapered cross-sections of the ramparts shown in Figs. 7C and 7D are formed in such a manner for example that the photoresist layer is treated with C_6H_5Cl . There may be formed the other cross-sections of the ramparts shown in Figs. 7E to 7H as far as overhanging portions exist.

After the formation of the ramparts, the organic function layer formation step is performed as shown in Figs. 8A to 8D. The organic EL media are disposed on the exposed first display electrodes 3 respectively, so

that at least one organic function layer is formed per one emitting portion. After that, in the second display electrode formation step, the second display electrodes are formed on the organic function layers. In the following figures, only one set of RGB emitting layers are shown for one pixel, but in practice a plurality of pixels are formed simultaneously in a coplanar plan of the substrate.

Fig. 8A shows in detail the organic function layer formation step. While openings 31 of the shadow mask 30 are aligned to portions of the substrate 2 each surrounded by the rampart 7 and the shadow mask is put and fixed onto top surfaces of the ramparts. After that, first organic function layers 8R for a first color emission (e.g., red) are vacuum-deposited at a predetermined thickness through the openings onto the first display electrodes 3 between the ramparts. The substrate is preferably placed during the vacuum-deposition in such a manner that the vapor of the organic EL medium goes around the overhanging portion and reaches portions under the overhanging portion. There is not restriction of angle of the substrate surface to the vapor flow. In this way, the first color organic function layers are formed on the first display electrodes respectively. In addition, in case that the organic function layer of the three-layer structure (e.g., an organic hole transport layer, an organic emitting layer and an organic electron transport layer) is formed, the corresponding different organic media may be vacuum-deposited in this step. In the later each step for the function layer, this multi-deposition may be performed similarly.

In the step of Fig. 8B, the shadow mask is shifted toward the left by one rampart so that the openings are aligned to the adjacent rampart spaces, and then the mask is fixed onto top surfaces of the ramparts. After that, second organic function layers 8G for a second color emission (e.g., green) are vacuum-deposited at a predetermined thickness onto the first display electrodes 3.

In the step of Fig. 8C, the shadow mask is similarly shifted toward the left by one rampart so that the openings are aligned to the adjacent rampart spaces, and then the mask is fixed onto top surfaces of the ramparts. After that, third organic function layers 8B for a third color emission (e.g., blue) are vacuum-deposited at the predetermined thickness onto the first display electrodes 3.

In this way, it is preferable that the mask putting and aligning step and the media depositing step are repeated in such a manner of that the shadow mask is shifted to an adjacent portion where the openings aligned to adjacent other first display electrodes, since the manufacturing of the panel is improved conveniently. The rampart 7 is useful to prevent the shadow mask from damaging the organic function layer when the aligning, shifting and putting of the mask are performed in the vacuum-depositions of the organic function layers.

Fig. 8D shows a step for forming the second display electrodes 9 in which, after the shadow mask for the organic function layers are removed, a low resistance metal such as Al, Mg, Au and the like and an alloy thereof is vacuum-deposited as cathodes 9 with a pre-determined thickness on the resulting RGB organic function layers 8 in such a manner that the metal vapor drops perpendicular to the substrate without step coverage. It is noted that the metal vapor flow is substantially vertical to the surface of the substrate so that the overhanging portion 7a of the rampart prevents the deposition of the metal thereunder on the edges of the organic function layer or at least, lower face of the overhanging portion per se.

The overhanging portion 7a of the rampart divides the metal layer deposited by the vertical metal vapor flow to the substrate, so that the cathode 9 is formed physically electrically apart from the metal layer deposited on the top face of the rampart as shown in Fig. 8D. Therefore, the adjacent cathodes 9 sandwiching the rampart are electrically disconnected to each other. Moreover, the combination of the vertical metal vapor flow and the overhanging portion also causes the electrical insulation between the cathode 9 and the ITO anode 3 to prevent a short circuit therebetween, since the metal vapor flow going around the overhanging portion 7a does not reach so far as the edge of the organic function layer 8 of the organic EL medium previously formed so that the organic function layer 8 appears from the cathode 9 as shown in Fig. 8D. Thickness of the metal cathode is not restricted as far as it does not provide any short circuit. For the metal cathode a low resistance metal such as Al, Mg, Cu, Au and the like and an alloy thereof is used.

Next, Figs. 9A to 9C show another embodiment process for an organic EL display panel carrying ramparts of reverse tapered cross-section.

As shown in Fig. 9A, the ramparts 7 each having the reverse tapered cross-section are formed on the substrate 2 on which the ITO anode 3 with a predetermined pattern previously formed in a way that a site 9a to be an edge of the cathode takes shelter from the metal vapor flow vertically dropped later by means of overhanging portion 7a.

As shown in Fig. 9B, by using the shadow mask 30 the RGB organic function layers are formed in turn on the substrate 2 in the same manner mentioned above. Since the shadow mask contacts via the rampart serving as a spacer to the organic EL medium during the vacuum-deposition, the mask can not damage the organic function layer due to a gap between the shadow mask and the ITO anode or the organic function layer maintained by the rampart. In addition, this vacuum-deposition is performed while the substrate is rotated with respect to an axis extending normally to the surface thereof in order that the EL medium goes around the overhang of the reverse tapered rampart and reaches the base thereof. Instead of the rotation of the substrate, a plurality of vapor sources may be used for entering the

EL medium to the root of the reverse tapered rampart from various directions based on the sources. The deposition of EL medium at the root of the rampart is efficient for the wide spread organic function layer preventing a short-circuit between the ITO anode and the cathode formed later.

As shown in Fig. 9C, the cathode material of metal is vacuum-deposited perpendicular to the surface of the substrate. As seen from the figure, the overhanging portion 7a of the reverse tapered rampart interrupts the metal vapor flow from the root adjacent to the site 9a to be a cathode edge. In this way, both the electrical separations of the adjacent cathodes between which the rampart is put and of the ITO anode and the cathode pattern are simultaneously achieved.

Last, after the sealing against moisture is performed, an organic EL full-color display panel is obtained.

Of course, the organic EL full-color display panel may be formed as a monochrome display panel by depositing single color organic function layers instead of RGB organic function layers of the steps as shown in Fig. 9B and Fig. 8A to 8C. In addition, another EL full-color display panel may be obtained when RGB filters are provided and white color organic function layers are formed on the substrate.

The organic EL display panel according to the present invention does not lose its inherent performance for a long period, since there is no process with probability of damaging the organic function layer such as the wet type photolithography after the formation step of the organic EL layers. In addition, since the cathode is formed with the vertical metal flow, the flexible cathode pattern may be obtained. Further, the reverse tapered rampart may be formed by the photolithography at a fine patterning with a precision of 10 micrometers or less.

The feature of the present invention of the organic EL display panel is the existence of ramparts on the substrate each comprising the overhanging portion and having a T-shaped cross-section or the reverse tapered cross-section at the portion or the whole thereof. The feature of the method according to the present invention is that the organic EL medium material vapor flow goes around the overhanging portion closer to the base of the reverse tapered or T-shaped rampart than the cathode metal material vapor flow.

(EXAMPLE 1)

An organic EL display panel was fabricated in that the rampart on the substrate was made of a photoresist of chemically amplified type.

ITO anodes were patterned in the stripe form on a glass substrate, and then the substrate was sufficiently washed. The nega-photoresist LAX-1 (available from Nippon Zeon Co. Ltd.) was spin-coated at a thickness of 5.6 micrometers as a layer on the substrate. Then, the coated substrate was pre-baked in a warm air current

circulatory oven. After that, a photo mask providing parallel slits for cathodes each width of 20 micrometers was put on the photoresist layer in a manner that the slits extends perpendicular to the ITO stripes. Then, the photoresist layer was exposed with a pertinent radiation through the slits of the photo mask. Subsequently, the photoresist layer was performed with P.E.B in the warm air current circulatory oven and was developed, so that reverse tapered ramparts each having a width of 20 micrometers and a height of approximately 5.6 micrometers were formed (see Fig. 10 showing a scanning electron microphotograph of the rampart).

After a shadow mask provided with openings each corresponding to a recess between ramparts was put on the ramparts, N, N'-diphenyl-N,N'-bis(3-methylphenyl)-1,1'-biphenyl-4,4'-diamine (so-called "TPD") was vacuum-deposited at a 700 angstroms thickness through the openings onto the surface carrying the ramparts while the substrate is rotated with respect to an axis extending normally to the surface thereof. in order that the EL medium goes around the overhang of the reverse tapered rampart and reaches the base thereof. Subsequently, Aluminum oxine chelate (hereinafter referred as "Alq₃") was vacuum-deposited at a 550 angstroms thickness in the same manner. After the depositions, the substrate was stopped to rotate. Aluminum was vacuum-deposited at a 1000 angstroms as cathodes in a manner that Al vapor flow is perpendicular to the substrate (see Fig. 11 of a scanning electron microphotograph showing portins adjacent to the rampart).

As seen from Fig. 11, the Al layer on the top of the rampart is divided from that of on the substrate at the edge of the Al cathode layer on the substrate near the base of the rampart, so that the adjacent Al cathode lines formed on the substrate are electrically disconnected to one another. In addition, the edge of the organic function layer comprising TPD and Alq₃ sticks out from the edge of the Al cathode layer, so that any short-circuit between the Al cathode and the ITO anode does not occur.

(EXAMPLE 2)

Another organic EL display panel was fabricated in that the rampart of a photoresist on the substrate was treated with C₆H₅Cl.

ITO anodes were patterned in the stripe form on a glass substrate, and then the substrate was sufficiently washed. The posi-photoresist AZ6112 (available from Hoechst Japan Ltd.) was spin-coated at a thickness of approximately one micrometer as a layer on the substrate. Then, the coated substrate was pre-baked in a warm air current circulatory oven. After that, the coated substrate was dipped into a C₆H₅Cl fluid at a temperature of 32°C for 30 minutes. Then, a photo mask providing parallel slits for cathodes each width of 2 micrometers was put on the photoresist layer in a manner that the slits extends perpendicular to the ITO stripes. Then, the photoresist layer was exposed with a

pertinent radiation through the slits of the photo mask. Subsequently, the photoresist layer was developed, so that reverse tapered ramparts each having a width of 2 micrometers and a height of approximately one micrometer were formed (see Fig. 12 showing a scanning electron microphotograph of the rampart).

Next, an organic function layer comprising TPD and Alq₃ and an Al cathode layer were formed in the same manner that of EXAMPLE 1.

As a result, the Al layer on the top of the rampart was divided from that of on the substrate at the edge of the Al cathode layer on the substrate near the base of the rampart, so that the adjacent Al cathode lines formed on the substrate were electrically disconnected to one another. In addition, the edge of the organic function layer comprising TPD and Alq₃ stuck out from the edge of the Al cathode layer, so that any short-circuit between the Al cathode and the ITO anode did not occur.

According to the present invention, it makes sure of automatically completely patterning of the cathode lines without use of the photolithography for the cathode patterning, since the Al layer on the top of the rampart with overhanging portions is electrically separated from that of on the substrate during the vacuum deposition. In addition, the film formation of the organic function layer with using the rampart and the shadow mask put thereto realizes an available separation of the organic function layers, so that a colorful fine full color display panel comprising organic function layers is manufactured without deterioration of the organic function layer nor any leakage of EL medium to adjacent pixels. The number of the steps in the manufacturing is therefore reduced than those of the prior art, the separation of the RGB organic function layers is surely achieved so that the RGB media are shared with a high precision.

(EXAMPLE 3)

Another full color display panel in which nonlinear elements each including thin film transistors (TFT) and capacitors connected to the second display electrodes is fabricated together with scan signal lines and data signal lines on the substrate as shown in Fig. 13. As seen from the figure, ITO anode layers 3, organic function layers 8 and second display electrodes 9 are previously formed on a glass substrate 2 as a front substrate in the same manner as the forgoing embodiments. Individually, a back glass substrate 102 carrying nonlinear elements 101 connected to the second display electrodes 9 and the scan data signal lines are formed correspondingly to the number of predetermined pixels. Thus, an anisotropic conductive adhesive 103 adheres both the front and back substrates so that the nonlinear elements 101 are electrically connected only to the corresponding second display electrodes 9 respectively to result in a flat display panel.

In the formation of the TFT EL flat display panel, it should be noted that individual cathode and organic

function layer precisely corresponds separately to each emitting portion of the pixel, and further one of the cathode is perfectly insulative electrically to the adjacent cathode. This requirement is achieved by another embodiment of the present invention that the T-shaped cross-section or reverse tapered ramparts with overhanging portion are formed in the form of a two dimension matrix.

In addition, the present invention realizes an organic electroluminescent display panel and method for manufacturing the same which are capable not only of being manufactured with a freely flexible patterning without deterioration of the organic function layer, cathode and other elements, but also of preventing any puncture of the first and second display electrodes and the organic function layer with a high yield rate in the production thereof. Namely, in Example 4, at least one insulative layer is inserted between the first and second display electrodes under the overhanging portion of the rampart. In Example 5, the ramparts and the second display electrodes are covered with an insulative sealing film.

(EXAMPLE 4) Addition of an insulative layer

There are manufactured an organic EL display panel including insulative layers preventing the short-circuit between the first and the second display electrodes, particularly at the edge of the second display electrode.

As shown in Fig. 14A, after the first display electrodes 3 (ITO anodes) are previously formed in the predetermined pattern on the substrate, insulative layers 40 are formed on the sites planed to be at edges of the second display electrodes formed later.

As shown in Fig. 14B, the ramparts 7 each having the reverse tapered cross-section are formed on the insulative layers 40 and the substrate 2 in a way that each overhanging portion 7a of the ramparts 7 covers the insulative layer at the site planed to be at edges of the second display electrodes formed later. The insulative layers 40 are formed on gaps between the second display electrodes or patterns to define the shape of the second display electrode.

As shown in Fig. 14C, by using the shadow mask 30 with the predetermined openings, the RGB organic function layers are formed in turn on the rotating substrate 2 in the same manner mentioned above. The shadow mask is contacted to the ramparts apart from the organic function layers during the vacuum-deposition. The mask thus did not damage the organic function layer.

As shown in Fig. 14D, the cathode metal material is vacuum-deposited as a whole to the surface of the substrate. This vacuum-deposition is performed by the angle θ less than a tapering angle θ' ($\theta < \theta'$) of the reverse tapered rampart with respect an axis extending normally to the substrate. The overhanging portion 7a of the reverse tapered rampart interrupted the metal vapor

flow from the root adjacent to the site to be a cathode edge, so that there are simultaneously achieved both the electrical separations of the adjacent cathodes between which the rampart is placed and of the ITO anode and the cathode. In addition, There is no short-circuit between the edges of the cathode i.e., the second display electrode and the previously formed ITO anode even when the deposited metal cathode crosses over the edge of the organic function layer because of the insulative layer 7 formed in the step of Fig. 14A.

Last, after the sealing against moisture is performed, an organic EL full-color display panel is obtained.

A monochrome EL display panel may be obtained if deposition of single color organic function layers are deposited, instead of RGB organic function layers of the steps as shown in Fig. 14C. In addition, another EL full-color display panel may be obtained when RGB filters are provided and white color organic function layers are formed on the substrate.

The area range of each insulative layer formed in the step of Fig. 14A is at least each edge portion (Fig. 15) of the adjacent second display electrodes and further at maxim the surface of the substrate other than emitting portion of displaying dots (segments) (see Fig. 19). For example, Fig. 15 shows the pattern of the insulative layers 40 in the insulative layer formation step of Fig. 14A in which a pair of the parallel insulative layer stripes 40a and 40b extending vertical to the first display electrode 3. In this case, these parallel insulative layer stripes 40a and 40b are formed as sandwiching the base of the rampart 7 as shown in Fig. 16. In another embodiment, the integrated insulative layers 40 may be formed so as to combine those parallel insulative stripes of Fig. 15 extending vertical to the first display electrode 3 as shown in Fig. 17. In this case, the ramparts 7 are formed along the center line of each integrated insulative layer 40 as shown in Fig. 18. In further another embodiment, the insulative layer may be formed so as to combine those vertical and lateral insulative stripes as shown in Fig. 19. That is, the insulative layer is formed on the surface of the substrate other than the exposed portions 50 of the first display electrode and the edge portions 60 of the first display electrodes. As a result, the insulative layer also prevents the short-circuit between the edge of the first display electrode and the second display electrode.

The organic EL display panel according to this embodiment maintains its inherent performance for a long period after the production, therefore a high yield rate of the production, since there is no process with probability of damaging the organic function layer such as the wet type photolithography after the formation step of the organic EL layers. In addition, since the direction of the deposition of the second display electrode is free, a variety of second display electrode patterns are achieved. In addition, the insulative layer placed between the edge of the second display electrode and the first display electrode prevents the short-

circuit therebetween. Moreover, the reverse tapered rampart and the insulative layer may be formed by the photolithography at a fine patterning with a precision of 10 micrometers or less.

Concretely, an organic EL display panel including the insulative layer placed between the edge of the second display electrode and the first display electrode was manufactured in substantially the same manner as Example 1 above mentioned, in which the insulative layer formation step was inserted between the first display electrode step and the rampart formation step.

ITO anodes were patterned in the stripe form on a glass substrate, and then the substrate was sufficiently washed. The photoresist OFPR-8000 (available from Tokyo Ohka Co. Ltd.) was spin-coated at a thickness of one micrometer as an insulative layer on the substrate. Then, the coated substrate with the insulative layer was prebaked in the warm air current circulatory oven. After that, a photo mask providing parallel slits for cathodes each width of 20 micrometers was put on the photoresist insulative layer in a manner that the slits extends perpendicular to the ITO stripes. Then, the photoresist layer was exposed with a pertinent radiation through the slits of the photo mask. Subsequently, the photoresist layer was developed and rinsed and then post-baked in the warm air current circulatory oven. In this way, the stripe insulative layer 40 as shown in Fig. 17 were formed.

Next, the nega-photoresist LAX-1 (available from Nippon Zeon Co. Ltd.) was spin-coated at a thickness of 5.6 micrometers as a layer on the substrate. Then, the coated substrate was pre-baked in a warm air current circulatory oven. After that, a photo mask providing parallel slits for cathodes each width of 18 micrometers was put on the photoresist layer in a manner that both the center lines of each insulative layer and each stripe slit of the photo mask (the line width 18 micrometers) are coincides with each other. Then, the photoresist layer was exposed with a pertinent radiation through the slits of the photo mask. Subsequently, the photoresist layer was performed with P.E.B in the warm air current circulatory oven and was developed, so that reverse tapered ramparts each having a width of 18 micrometers and a height of approximately 5.6 micrometers were formed. The tapering angle θ' of the reverse tapered rampart in respect to the normal line of the substrate was measured to be approximately 30 degree.

Next, the substrate 2 was fixed to the turntable provided in the vacuum chamber of the vacuum deposition device in the form shown in Fig. 20, and then the vacuum chamber was exhausted up to a pressure of -5×10^{-6} Torr and then the vacuum deposition was performed with a resistance heating method while the substrate was rotated with respect to an axis extending normally to the surface thereof. Under this condition TPD was vacuum-deposited at a 700 angstroms thickness. Subsequently, Alq_3 was vacuum-deposited at a 550 angstroms thickness in the same manner. Further, the second display electrode of Al was vacuum-depos-

ited at a 1000 angstroms thickness. In these cases each of the material vapor sources 55 corresponding the steps was placed under the substrate 2 and therefore the vapor flow biased by the angle $\theta = 20$ degree at maxim from the normal line of the substrate less than tapering angle $\theta' = 30$ degree the reverse tapered rampart. There was no measured the conductivity cross the adjacent Al lines between which the rampart exists so that a perfect electrical insulation was complete. In addition, upon application of 10 Volts across the ITO and Al electrodes of the resultant display panel, the selected organic function layers emitted a green light at a high luminance but not occurs any short-circuit therebetween.

(EXAMPLE 5) Addition of an insulative sealing film

An insulative sealing film is formed as surrounding the reverse tapered rampart and covering entirely the second display electrode pattern. A substrate carrying the second display electrodes is previously formed through the steps shown in Figs. 14A to 14D in the same manner of Example 4. The substrate is covered with an insulative sealing film 45 with a high damp-proof effect by using the vacuum deposition while the substrate is rotated, sputtering or CVD method.

The insulative sealing film is deposited in such a manner that the sealing material vapor goes around the over hanging portion toward the tapered side walls and the base of the reverse tapered rampart 7 as shown in Fig. 21. Therefore, the sealing material vapor reaches at the insulative layer 40 as shown in Fig. 22, so that the second display electrode lines 9 are perfectly covered the insulative sealing film 45. In addition, the insulative sealing film 45 may cover the tapered side walls of the reverse tapered rampart 7 as shown in Fig. 23. As far as the insulative layer 40 covers at least the second display electrode lines, the form thereof is not restricted.

Moreover, this sealing structure may be applied to the above mentioned Examples as well as Example 4 in which no insulative layer is formed in the panel. As shown in Fig. 24, the insulative sealing film is deposited in such a manner that the sealing material vapor goes around the over hanging portion toward the base of the reverse tapered rampart 7, so that the edges of the second display electrode 9 and the organic function layer 8 and the surface portion of the first display electrode 3 on the substrate are covered with the insulative sealing film 45. Alternatively, as shown in Fig. 25, all of the second display electrode lines 9, the reverse tapered rampart 7 including the tapered side walls and the like may be perfectly covered the insulative sealing film 45.

The present invention prevents non-emitting portions or dark spots growing or entering from the edge of the second display electrode to the organic function layer, since the insulative sealing film for perfectly covering the second display electrode pattern. In other words, the organic EL display panel according to the present invention has a very high durability.

Concretely, an organic EL display panel including the insulative layer and the insulative sealing film was manufactured in substantially the same manner as Example 4 above mentioned, in which the insulative sealing film formation step was added after the second display electrode formation step.

A substrate carrying the Al display electrodes was previously formed through steps in the same manner as Example 4. After that, by using the sputtering method, a SiO₂ layer was deposited as an insulative sealing film at a one micrometer thickness. There was no measured any conductivity between the adjacent Al lines between which the rampart exists so that a perfect electrical insulation was complete. In addition, upon application of 10 Volts across the ITO and Al electrodes of the resultant display panel, the selected organic function layers emitted a green light at a high luminance but not occurs any short-circuit therebetween. Furthermore, the resultant display panel did not have non-emitting portions in the organic function layer nor expansion thereof for a long period of several days in the air.

According to the present invention, the following advantageous effects are obtained.

(1) After the formation of the organic EL layers, it is unnecessary to perform a step with probability of damaging the organic function layer such as the photolithography. Due to existence of the ramparts, the protection of the organic function layer is stable and the damage of the layers is reduced.

(2) The number of the steps in the manufacturing is reduced than those of the prior art, the separation of the RGB organic function layers is surely achieved so that the RGB media are shared with a high precision.

(3) A freely flexible patterning on the substrate is realized without deterioration of the organic function layer, cathode and other elements.

It should thus be apparent that the scope of the teaching of this invention is not intended to be limited by only the embodiments that have been expressly disclosed and illustrated, but that instead the scope of the teaching of this invention should be read as being commensurate with the scope of the claims that follow.

Claims

1. An organic electroluminescent display panel having a plurality of emitting portions comprising;
 - a substrate on which a plurality of first display electrodes corresponding to emitting portions are formed;
 - electrical insulation ramparts projecting from the substrate for exposing at least portions of the first display electrodes respectively;
 - organic function layers each including at least one organic electroluminescent medium formed on exposed portions of the first display elec-

trodes;

second display electrodes formed on the organic function layers; and

each electrical insulation rampart having an overhanging portion projecting in a direction parallel to the substrate.

2. An organic electroluminescent display panel as set forth in claim 1 and further comprising; an insulative layer formed on portions of the first display electrodes to be under said overhanging portion and/or edges of the exposed portions of the first display electrodes.
3. An organic electroluminescent display panel as set forth in claim 1 and further comprising; an insulative sealing film entirely formed on the first display electrode, the organic function layers and the second display electrode; and at least the second display electrode being covered as a whole with the insulative sealing film.
4. An organic electroluminescent display panel as set forth in claim 1 and further comprising; an insulative sealing film entirely formed on the first display electrode, the organic function layers and the second display electrode; and at least the organic function layers being covered as a whole with the insulative sealing film.
5. An organic electroluminescent display panel as set forth in claim 1, wherein said first and the second display electrodes are formed as stripes respectively, and each first display electrode is arranged perpendicular to each second display electrode.
6. An organic electroluminescent display panel as set forth in claim 1, wherein said substrate and said first display electrode are transparent.
7. An organic electroluminescent display panel as set forth in claim 6 and further comprising; a reflective film formed on said second display electrode.
8. An organic electroluminescent display panel as set forth in claim 1, wherein said second display electrode is transparent.
9. An organic electroluminescent display panel as set forth in claim 8 and further comprising a reflective film formed on the first display electrode at the outer-side.
10. A method for manufacturing an organic EL display panel having a plurality of emitting portions comprising the steps of;
 - forming a plurality of first display electrodes corresponding to emitting portions on a substrate as a patterning step;

forming, on the substrate, electrically insulative ramparts for exposing at least portions of the first display electrodes and protruding from the substrate as a rampart formation step, said each electrical insulation rampart having an overhanging portion projecting in a direction parallel to the substrate preferably at an upper;

depositing organic electroluminescent media onto exposed portions of the first display electrodes respectively, thereby forming a plurality of organic function layers each including at least one organic electroluminescent medium on the first display electrodes; and

forming a plurality of second display electrodes formed on the organic function layers.

11. A method as set forth in claim 10, wherein said rampart formation step further comprises preferably the steps of;

forming entirely a rampart material layer on said substrate;

forming a resist mask with a predetermined pattern openings on the rampart material layer;

etching the rampart material layer through the openings of the resist mask by using a dry-etching or wet-etching, thereby forming the ramparts having said overhanging portions.

12. A method as set forth in claim 10; wherein the organic electroluminescent media depositing step further comprises preferably the steps of;

putting a shadow mask onto top surfaces of the ramparts, the shadow mask having a plurality of openings corresponding to the exposed portions of the first display electrodes, while aligning the openings to the first display electrodes respectively;

depositing organic electroluminescent media through the openings onto the first display electrodes between the ramparts respectively; and

repeating the mask putting and aligning step and the media depositing step in such a manner of that the shadow mask is shifted to an adjacent portion where the openings aligned to adjacent other first display electrodes.

13. A method as set forth in claim 10 and further comprising;

between said patterning step for said first display electrode and said rampart formation step,

forming insulative layers on portions of the first display electrodes to be under said overhanging portion and/or edges of the exposed portions of the first display electrodes.

14. A method as set forth in claim 10 and further comprising;

after forming step of the second display electrode,

forming entirely an insulative sealing film on

at least of the second display electrodes, so that the insulative sealing film formed on the first display electrode.

15. A method as set forth in claim 10 and further comprising;

after forming step of the second display electrode,

forming entirely an insulative sealing film on at least of the organic function layers, so that the insulative sealing film formed on the first display electrode.

16. A method as set forth in claim 14 and further comprising;

after forming step of the second display electrode,

forming entirely an insulative sealing film on at least of the second display electrodes, so that the insulative sealing film formed on the first display electrode.

17. An organic electroluminescent display panel as set forth in claim 2 and further comprising; an insulative sealing film entirely formed on the first display electrode, the organic function layers and the second display electrode; and at least the second display electrode being covered as a whole with the insulative sealing film.

FIG.1

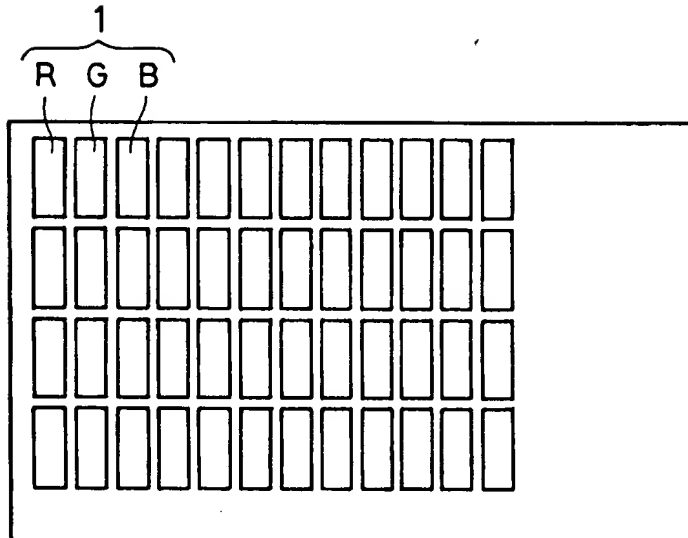


FIG.2

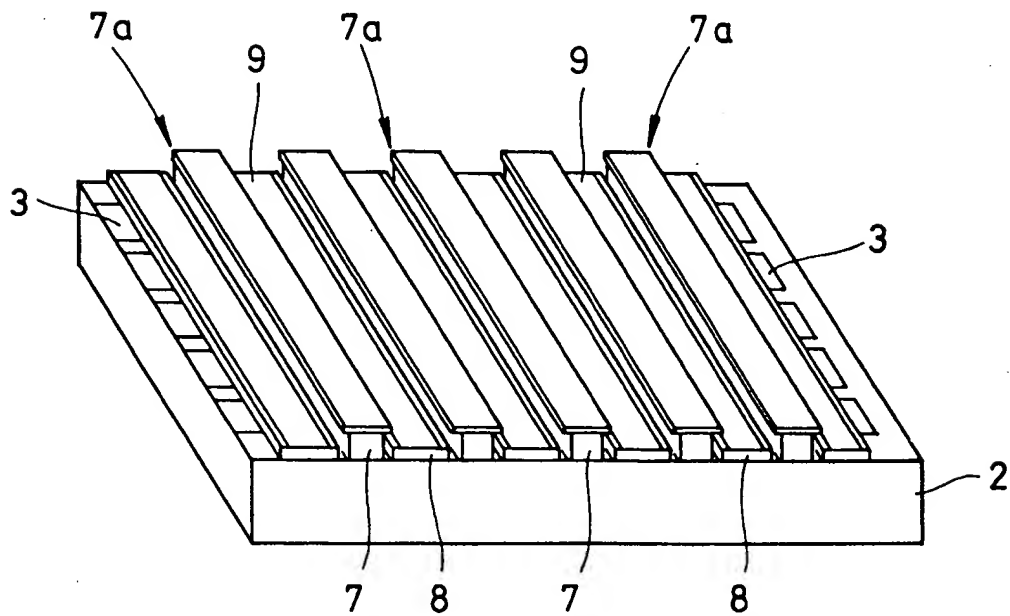


FIG. 3

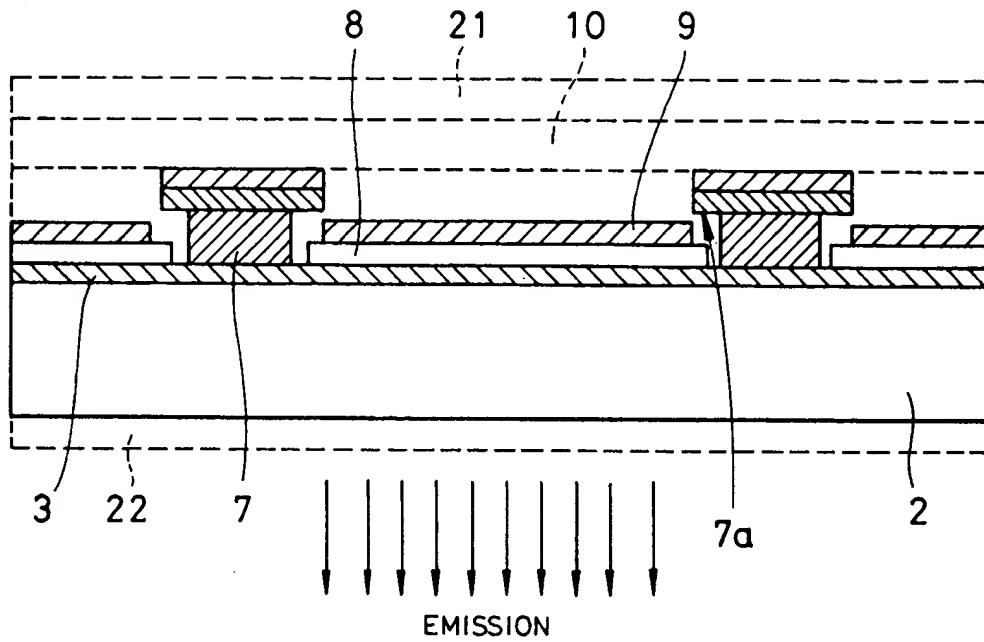
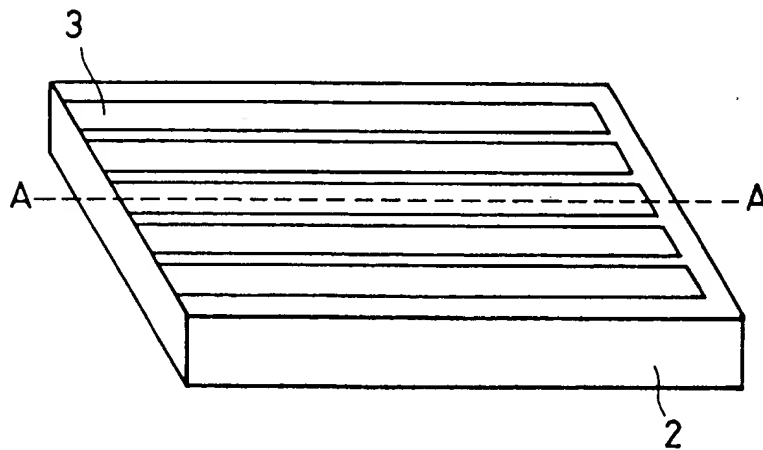


FIG. 4



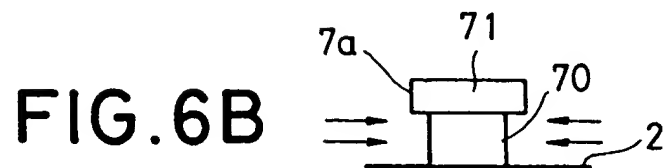
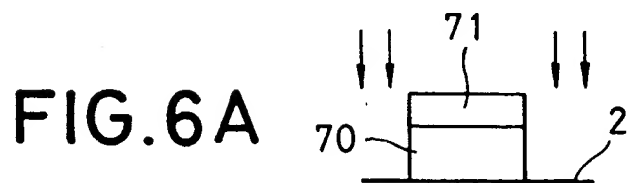
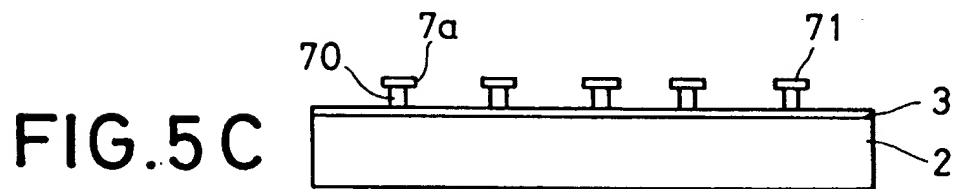
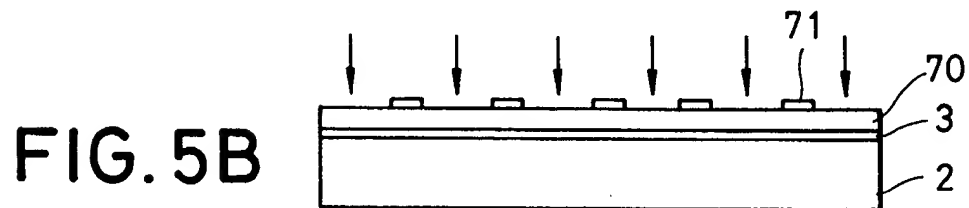
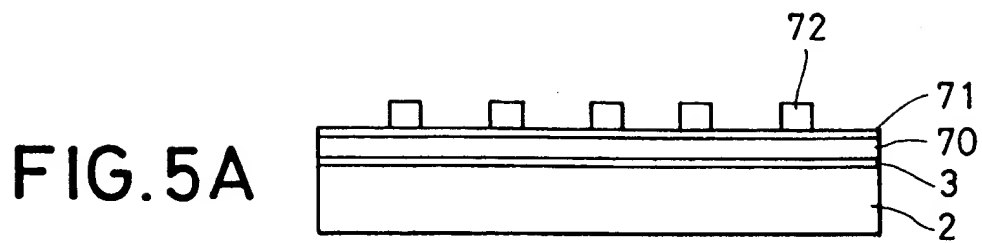
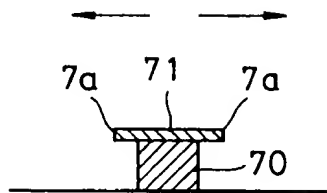
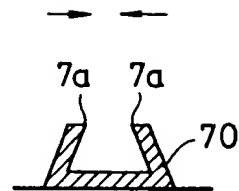


FIG.7A



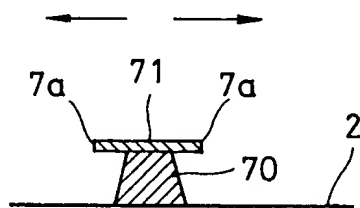
ARROWS INDICATE DIRECTIONS
OF OVERHANGING PORTIONS

FIG.7E



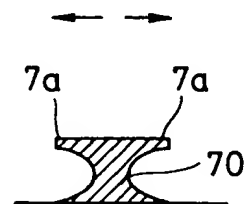
ARROWS INDICATE DIRECTIONS
OF OVERHANGING PORTIONS

FIG.7B



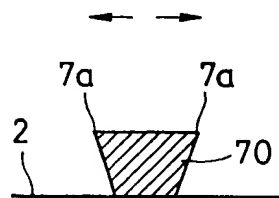
ARROWS INDICATE DIRECTIONS
OF OVERHANGING PORTIONS

FIG.7F



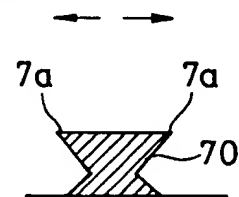
ARROWS INDICATE DIRECTIONS
OF OVERHANGING PORTIONS

FIG.7C



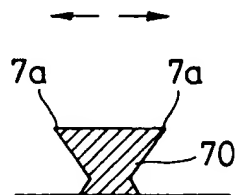
ARROWS INDICATE DIRECTIONS
OF OVERHANGING PORTIONS

FIG.7G



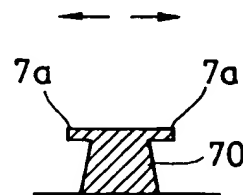
ARROWS INDICATE DIRECTIONS
OF OVERHANGING PORTIONS

FIG.7D



ARROWS INDICATE DIRECTIONS
OF OVERHANGING PORTIONS

FIG.7H



ARROWS INDICATE DIRECTIONS
OF OVERHANGING PORTIONS

FIG.8A

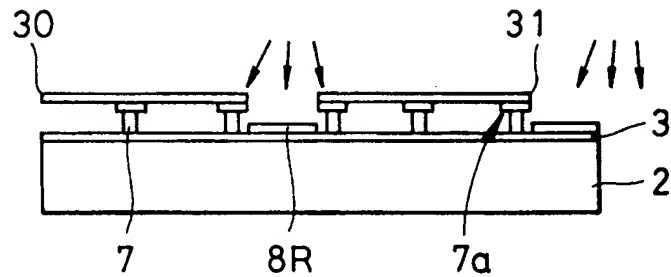


FIG.8B

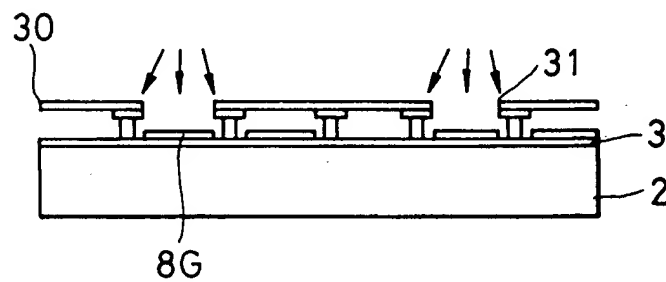


FIG.8C

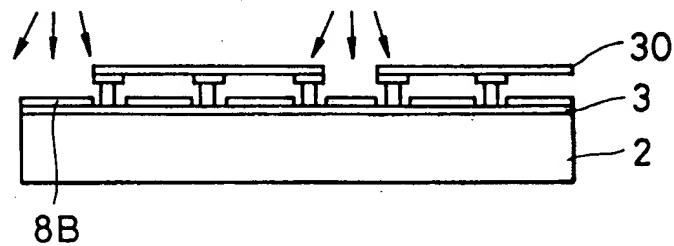


FIG.8D

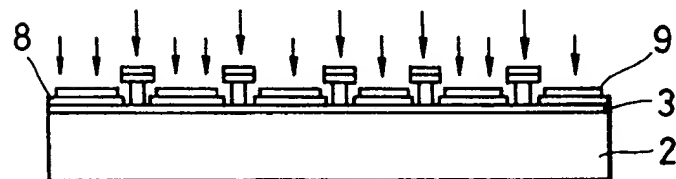


FIG. 9A

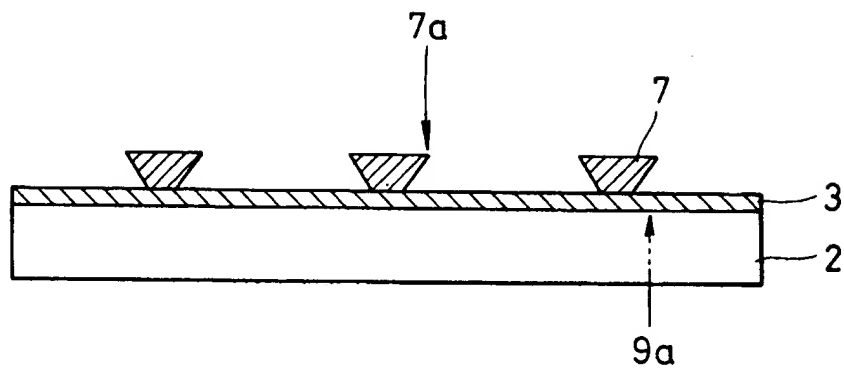


FIG. 9B

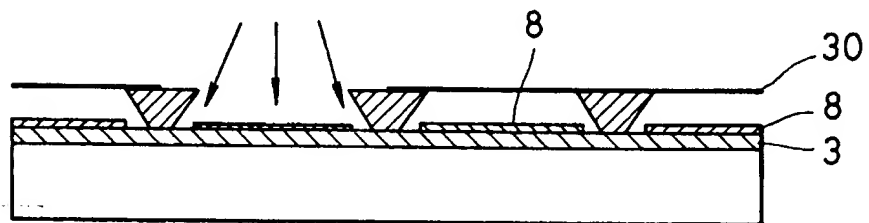


FIG. 9C

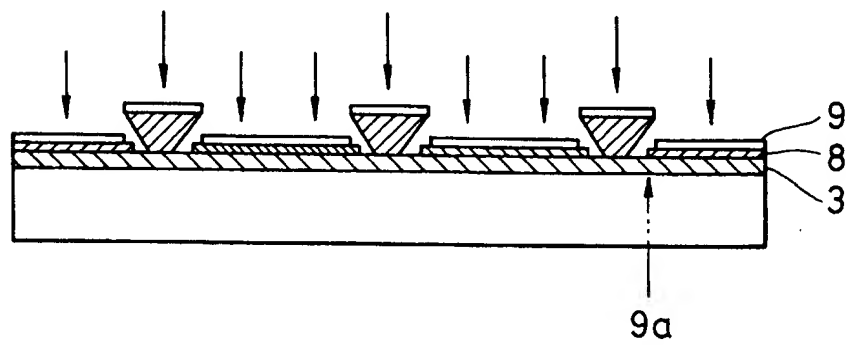


FIG.10

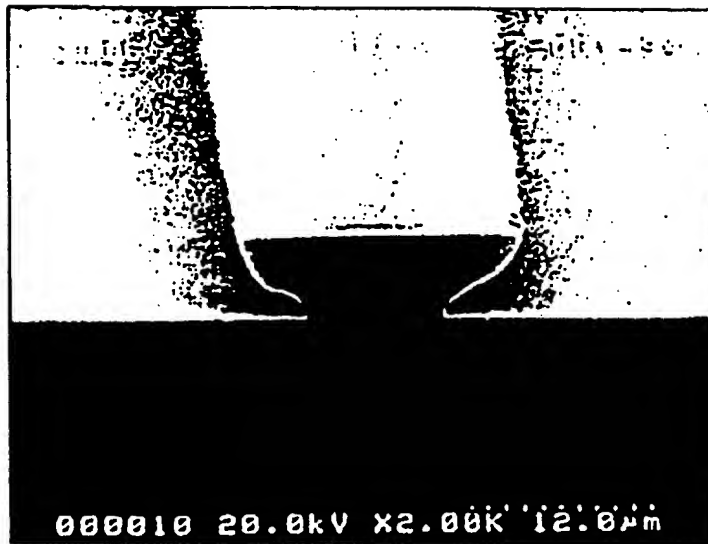


FIG.11

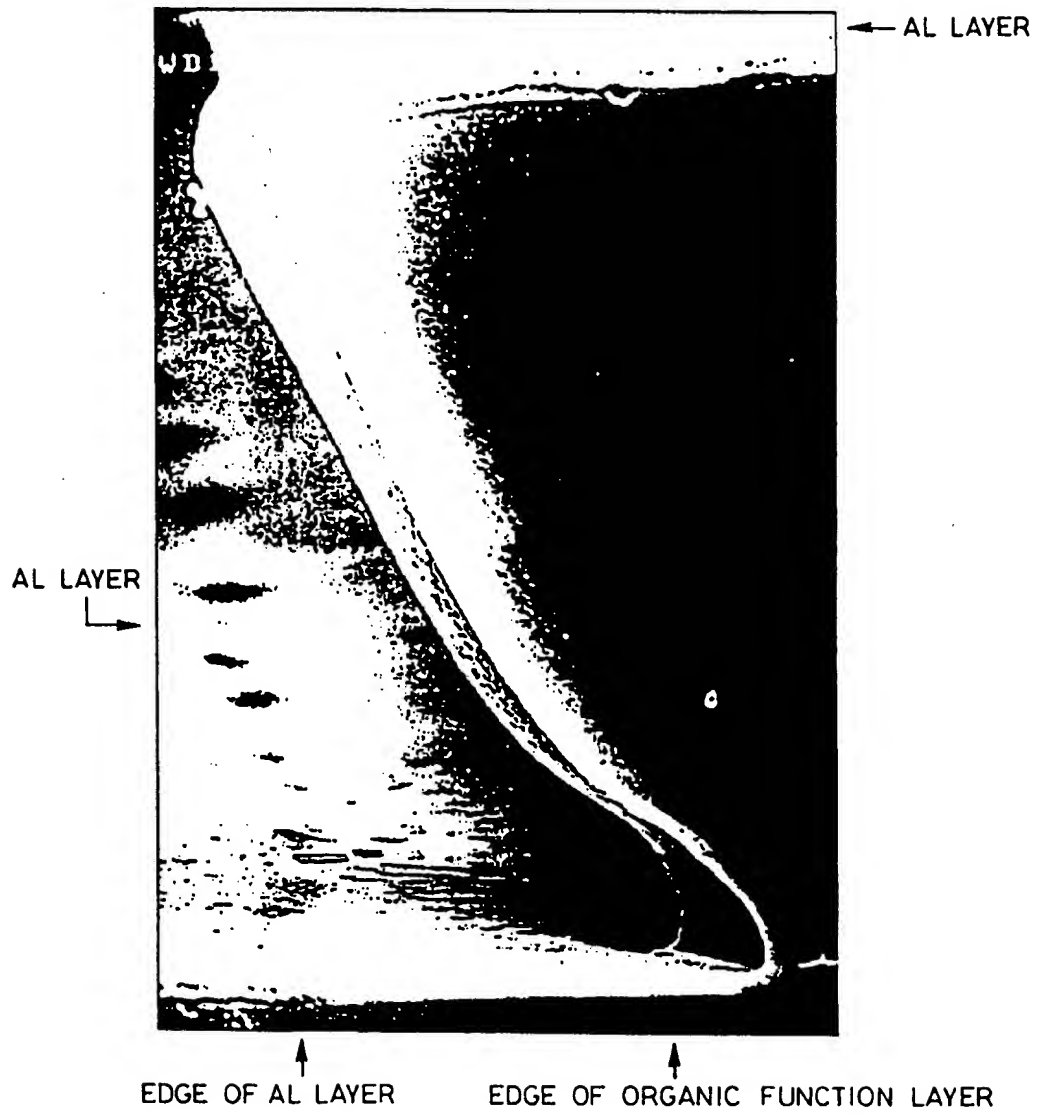


FIG.12



FIG.13

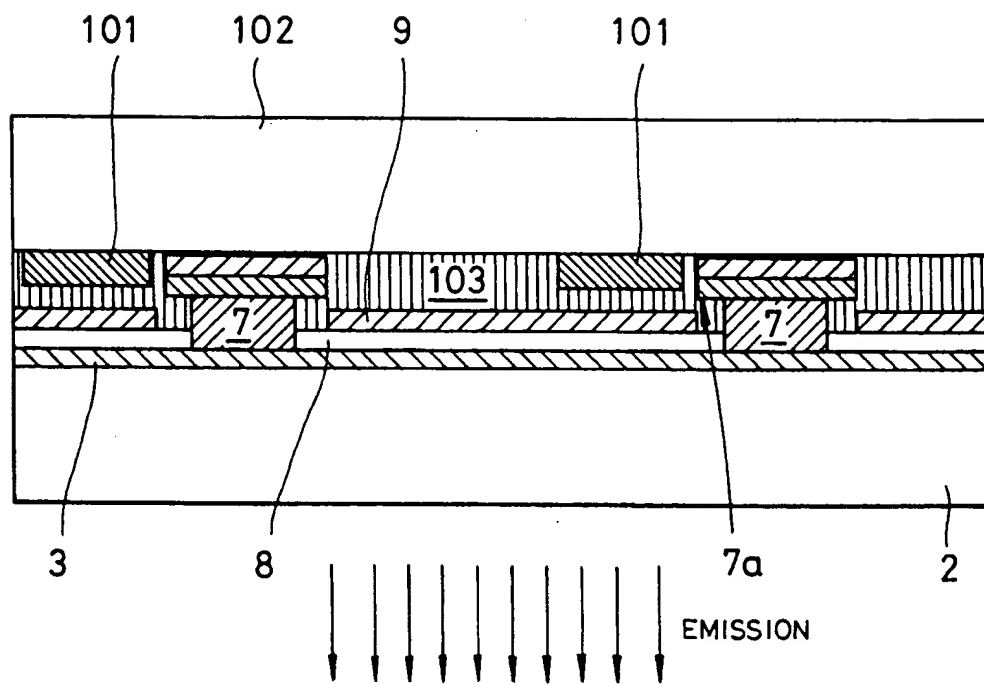


FIG.14A

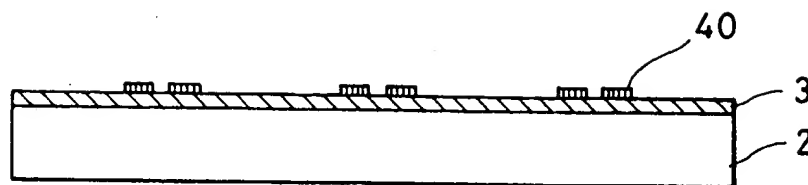


FIG.14B

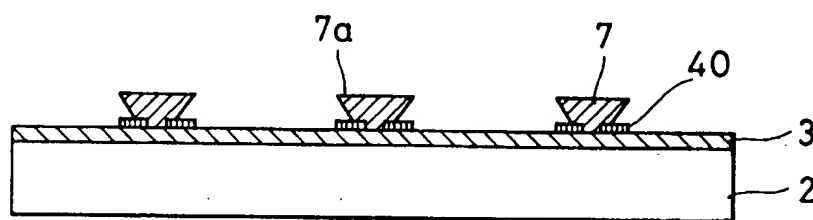


FIG.14C

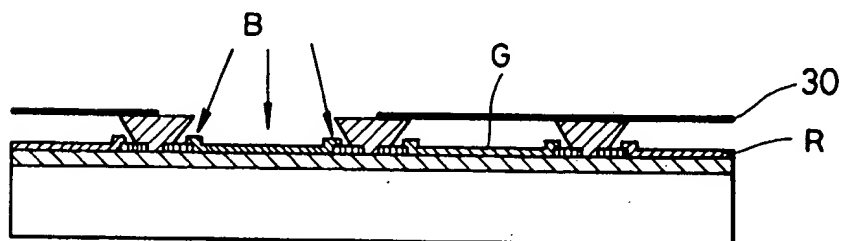


FIG.14D

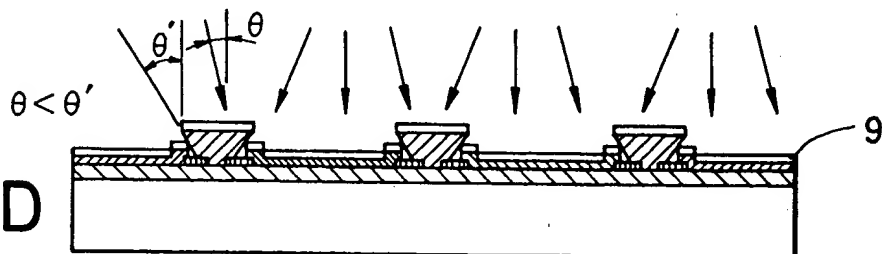


FIG.15

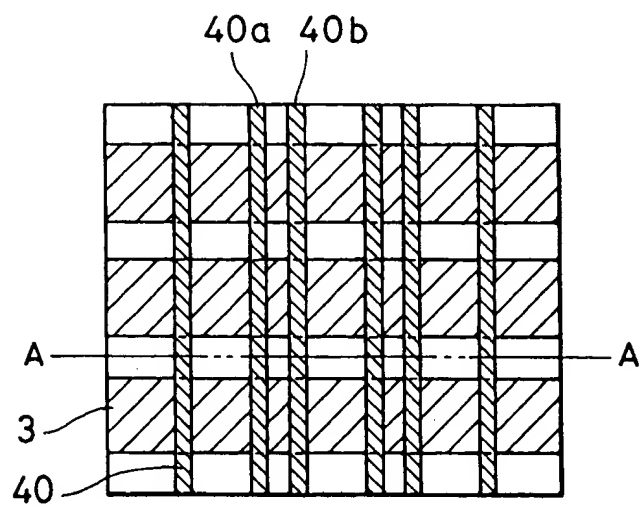


FIG.16

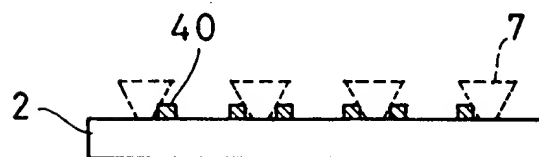


FIG.17

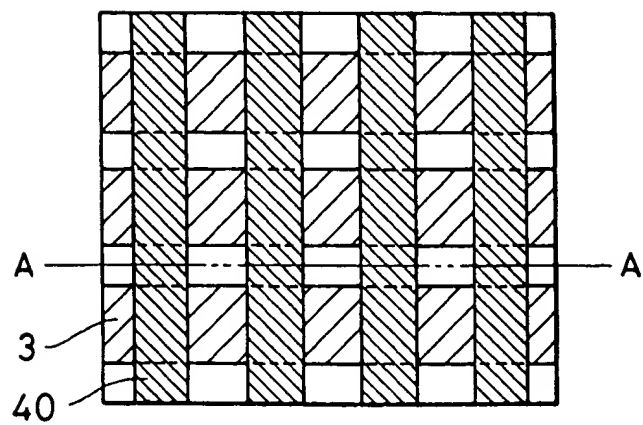


FIG.18

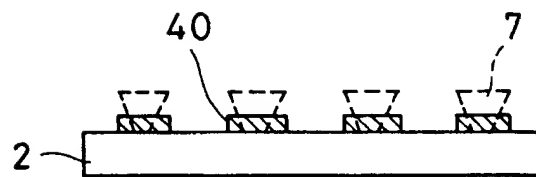


FIG.19

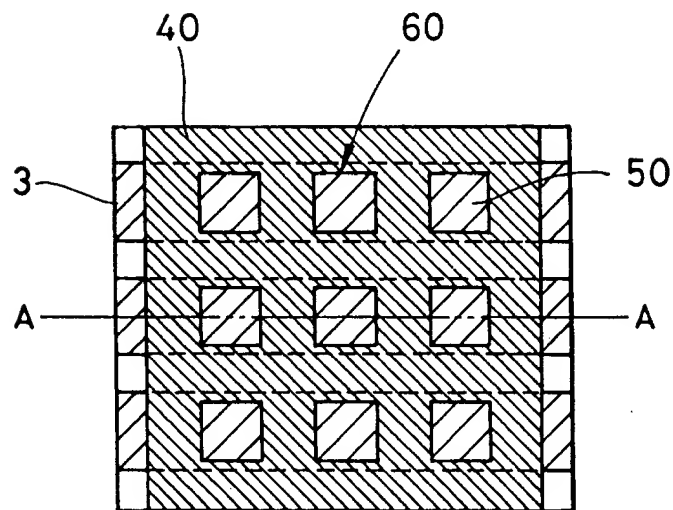


FIG. 20

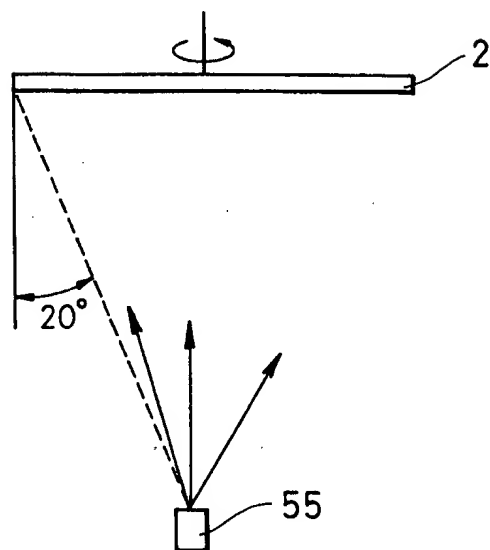


FIG. 21

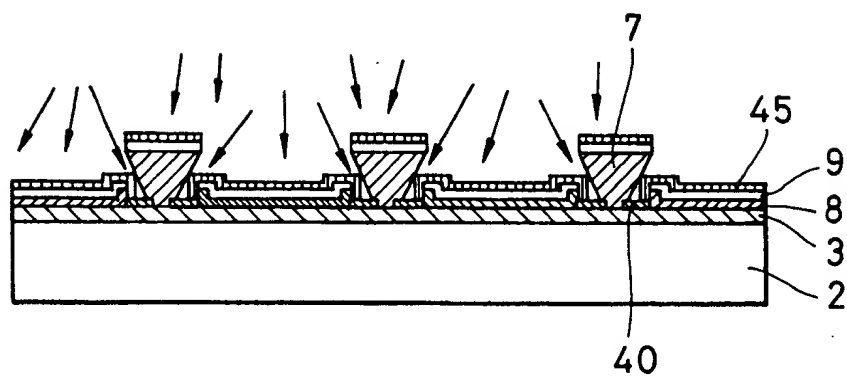


FIG.22

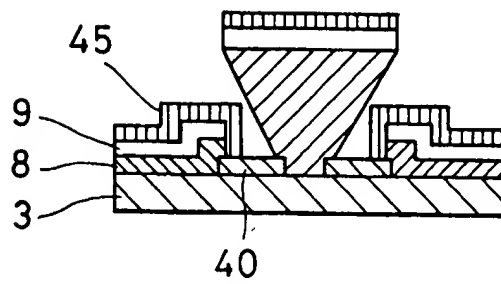


FIG.23

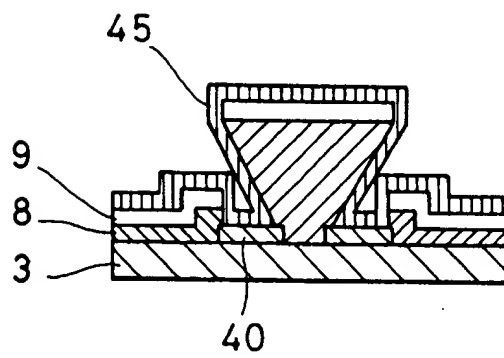


FIG. 24

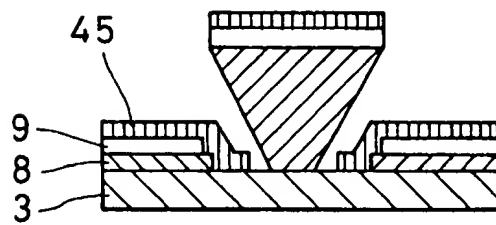
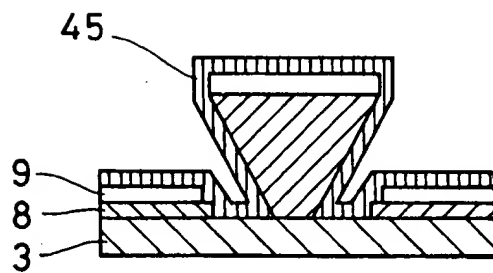


FIG. 25





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 96103890.8
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 6)
A	<u>EP - A - 0 639 937</u> (ULTRA SILICON) * Abstract; fig. 6 * --	1,10	H 05 B 33/12
A	<u>EP - A - 0 550 062</u> (EASTMAN KODAK) * Abstract; fig. * ----	1,10	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 6)
			H 05 B 33/00
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
VIENNA	28-06-1996	FELLNER	
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

APPENDIX III
Court Decisions

FULL TEXT OF CASES (USPQ2D)

All Other Cases

In re Fine (CA FC) 5 USPQ2d 1596 (1/26/1988)

In re Fine (CA FC) 5 USPQ2d 1596

In re Fine

U.S. Court of Appeals Federal Circuit
5 USPQ2d 1596

Decided January 26, 1988

No. 87-1319

Headnotes

PATENTS

1. Patentability/Validity -- Obviousness -- Evidence of (§ 115.0903)

Patent and Trademark Office improperly rejected claimed invention for obviousness since nothing in cited references, either alone or in combination, suggests or teaches claimed invention, since there is consequently no support for PTO's conclusion that substitution of one type of detector for another in prior art system, resulting in claimed invention, would have been obvious, and since PTO therefore failed to satisfy its burden of establishing prima facie case of obviousness by showing some objective teaching or generally available knowledge that would lead one skilled in art to combine teachings of existing references.

2. Patentability/Validity -- Obviousness -- In general (§ 115.0901)

Obviousness is tested by what combined teachings of prior art references would have suggested to those of ordinary skill in art, not by whether particular combination of elements from such references might have been "obvious to try."

3. Patentability/Validity -- Obviousness -- Evidence of (§ 115.0903)

Patent and Trademark Office erred, in rejecting as obvious system for detecting and measuring minute quantities of nitrogen compounds, by failing to recognize that appealed claims can be distinguished over combination of prior art references, in view of evidence demonstrating that prior art does not teach

claimed temperature range, despite some overlap of preferred temperature ranges for claimed invention and prior art, since purposes of preferred temperature ranges are different and overlap is mere happenstance.

4. Patentability/Validity -- Obviousness -- In general (§ 115.0901)

Dependent claims are non-obvious under 35 USC 103 if claims from which they depend are non-obvious.

Case History and Disposition:

Page 1597

Appeal from the U.S. Patent and Trademark Office Board of Patent Appeals and Interferences.

Application for patent by David H. Fine, Serial No. 512,374. From decision of Board of Patent Appeals and Interferences affirming rejection of application, applicant appeals. Reversed; Smith, circuit judge, dissenting with opinion.

Attorneys:

Morris Relson and Darby & Darby, New York, N.Y., (Beverly B. Goodwin with them on the brief) for appellant.

Lee E. Barrett, associate solicitor, Arlington, Va., (Joseph F. Nakamura, solicitor, and Fred E. McKelvey, deputy solicitor, with him on the brief) for appellee.

Judge:

Before Friedman, Smith, and Mayer, circuit judges.

Opinion Text

Opinion By:

Mayer, J.

David H. Fine appeals from a decision of the Board of Patent Appeals and Interferences of the United States Patent and Trademark Office (Board) affirming the rejection of certain claims of his application, Serial No. 512,374, and concluding that his invention would have been obvious to one of ordinary skill in the art and was therefore unpatentable under 35 U.S.C. §103. We reverse.

Background

A. The Invention .

The invention claimed is a system for detecting and measuring minute quantities of nitrogen compounds. According to Fine, the system has the ability to detect the presence of nitrogen compounds in quantities as minute as one part in one billion, and is an effective means to detect drugs and explosives, which emanate nitrogen compound vapors even when they are concealed in luggage and

closed containers.

The claimed invention has three major components: (1) a gas chromatograph which separates a gaseous sample into its constituent parts; (2) a converter which converts the nitrogen compound effluent output of the chromatograph into nitric oxide in a hot, oxygen-rich environment; and (3) a detector for measuring the level of nitric oxide. The claimed invention's sensitivity is achieved by combining nitric oxide with ozone to produce nitrogen dioxide which concurrently causes a detectable luminescence.

The luminescence, which is measured by a visual detector, shows the level of nitric oxide which in turn is a measure of nitrogen compounds found in the sample.

The appealed claims were rejected by the Patent and Trademark Office (PTO) under 35 U.S.C. §103. Claims 60, 63, 77 and 80 were rejected as unpatentable over Eads, Patent No. 3,650,696 (Eads) in view of Warnick, et al., Patent No. 3,746,513 (Warnick). Claims 62, 68, 69, 79, 85 and 86 were rejected as unpatentable over Eads and Warnick in view of Glass, et al., Patent No. 3,207,585 (Glass).

B. The Prior Art .

1. Eads Patent .

Eads discloses a method for separating, identifying and quantitatively monitoring sulfur compounds. The Eads system is used primarily in "air pollution control work in the scientific characterization of odors from sulfur compounds."

The problem addressed by Eads is the tendency of sulfur compounds "to adhere to or react with the surface materials of the sampling and analytical equipment, and/or react with the liquid or gaseous materials in the equipment." Because of this, the accuracy

Page 1598

of measurement is impaired. To solve the problem, the Eads system collects an air sample containing sulfur compounds in a sulfur-free methanol solution. The liquid is inserted into a gas chromatograph which separates the various sulfur compounds. The compounds are next sent through a pyrolysis furnace where they are oxidized to form sulfur dioxide. Finally, the sulfur dioxide passes through a measuring device called a microcoulometer which uses titration cells to calculate the concentration of sulfur compounds in the sample.

2. Warnick Patent .

Warnick is directed to a means for detecting the quantity of pollutants in the atmosphere. By measuring the chemiluminescence of the reaction between nitric oxide and ozone, the Warnick device can detect the concentration of nitric oxide in a sample gaseous mixture.

Warnick calls for "continuously flowing" a sample gaseous mixture and a reactant containing ozone into a reaction chamber. The chemiluminescence from the resulting reaction is transmitted through a light-transmitting element to produce continuous readouts of the total amount of nitric oxide present in the sample.

3. Glass Patent.

The invention disclosed in Glass is a device for "completely burning a measured amount of a substance and analyzing the combustion products." A fixed amount of a liquid petroleum sample and oxygen are supplied to a flame. The flame is then spark-ignited, causing the sample to burn. The resulting combustion products are then collected and measured, and from this measurement the hydrogen concentration in the sample is computed.

C. The Rejection .

The Examiner rejected claims 60, 63, 77 and 80 because "substitution of the [nitric oxide] detector of Warnick for the sulfur detector of Eads would be an obvious consideration if interested in nitrogen compounds, and would yield the claimed invention." He further asserted that "Eads teaches the

[claimed] combination of chromatograph, combustion, and detection, in that order. . . . Substitution of detectors to measure any component of interest is well within the skill of the art." In rejecting claims 62, 68, 69, 79, 85 and 86, the Examiner said, "Glass et al. teach a flame conversion means followed by a detector, and substitution of the flame conversion means of Glass et al. for the furnace of Eads would be an obvious equivalent and would yield the claimed invention." The Board affirmed the Examiner's rejection.

Discussion

A. Standard of Review .

Obviousness under 35 U.S.C. §103 is " 'a legal conclusion based on factual evidence.' " *Stratoflex, Inc. v. Aeroquip Corp.* , 713 F.2d 1530, 1535, 218 USPQ 871, 876 (Fed. Cir. 1983) (quoting *Stevenson v. Int'l Trade Comm'n* , 612 F.2d 546, 549, 204 USPQ 276, 279 (CCPA 1979)). Therefore, an obviousness determination is not reviewed under the clearly erroneous standard applicable to fact findings, *Raytheon Co. v. Roper Corp.* , 724 F.2d 951, 956, 220 USPQ 592, 596 (Fed. Cir. 1983); it is "reviewed for correctness or error as a matter of law." *In re De Blauwe* , 736 F.2d 699, 703, 222 USPQ 191, 195 (Fed. Cir. 1984).

To reach a proper conclusion under §103, the decisionmaker must step backward in time and into the shoes worn by [a person having ordinary skill in the art] when the invention was unknown and just before it was made. In light of *all* the evidence, the decisionmaker must then determine whether . . . the claimed invention as a whole would have been obvious at *that* time to *that* person. 35 U.S.C. §103. The answer to that question partakes more of the nature of law than of fact, for it is an ultimate conclusion based on a foundation formed of all the probative facts.

Panduit Corp. v. Dennison Mfg. Co. , 810 F.2d 1561, 1566, 1 USPQ2d 1593, 1595-96 (Fed. Cir. 1987).

B. Prima Facie Obviousness .

Fine says the PTO has not established a *prima facie* case of obviousness. He contends the references applied by the Board and Examiner were improperly combined, using hindsight reconstruction, without evidence to support the combination and in the face of contrary teachings in the prior art. He argues that the appealed claims were rejected because the PTO thought it would have been "obvious to try" the claimed invention, an unacceptable basis for rejection.

[1] We agree. The PTO has the burden under section 103 to establish a *prima facie* case of obviousness. See *In re Piasecki* , 745 F.2d 1468, 1471-72, 223 USPQ 785, 787-87 (Fed. Cir. 1984). It can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. *In re Lulu* , 747 F.2d 703, 705, 223 USPQ 1257, 1258 (Fed. Cir. 1984); see also *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.* ,

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776 F.2d 281, 297 n.24, 227 USPQ 657, 667 n.24 (Fed. Cir. 1985); *ACS Hosp. Sys., Inc. v. Montefiore Hosp.* , 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). This it has not done. The Board points to nothing in the cited references, either alone or in combination, suggesting or teaching Fine's invention.

The primary basis for the Board's affirmance of the Examiner's rejection was that it would have been obvious to substitute the Warnick nitric oxide detector for the Eads sulfur dioxide detector in the Eads system. The Board reiterated the Examiner's bald assertion that "substitution of one type of detector for another in the system of Eads would have been within the skill of the art," but neither of them offered any support for or explanation of this conclusion.

Eads is limited to the analysis of sulfur compounds. The particular problem addressed there is the difficulty of obtaining precise measurements of sulfur compounds because of the tendency of sulfur dioxide to adhere to or react with the sampling analytic equipment or the liquid or gaseous materials in

the equipment. It solves this problem by suggesting that the gaseous sample containing sulfur compounds be absorbed into sulfur-free methanol and then inserted into a gas chromatograph to separate the sulfur compounds.

There is no suggestion in Eads, which focuses on the unique difficulties inherent in the measurement of sulfur, to use that arrangement to detect nitrogen compounds. In fact, Eads says that the presence of nitrogen is undesirable because the concentration of the titration cell components in the sulfur detector is adversely affected by substantial amounts of nitrogen compounds in the sample. So, instead of suggesting that the system be used to detect nitrogen compounds, Eads deliberately seeks to avoid them; it warns against rather than teaches Fine's invention. See *W. L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540, 1550, 220 USPQ 303, 311 (Fed. Cir. 1983) (error to find obviousness where references "diverge from and teach away from the invention at hand"). In the face of this, one skilled in the art would not be expected to combine a nitrogen-related detector with the Eads system. Accordingly, there is no suggestion to combine Eads and Warnick.

Likewise, the teachings of Warnick are inconsistent with the claimed invention, to some extent. The Warnick claims are directed to a gas stream from engine exhaust "continuously flowing the gaseous mixtures into the reaction chamber" to obtain "continuous readouts" of the amount of nitric oxide in the sample. The other words, it contemplates measuring the total amount of nitric oxide in a continuously flowing gaseous mixture of unseparated nitrogen constituents. By contrast, in Fine each nitrogen compound constituent of the gaseous sample is retained in the Chromatograph for an individual time period so that each exists in discrete, time-separated pulses. *By this process, each constituent may be both identified by its position in time sequence, and measured. The claimed system, therefore, diverges from Warnick and teaches advantages not appreciated or contemplated by it.

Because neither Warnick nor Eads, alone or in combination, suggests the claimed invention, the Board erred in affirming the Examiner's conclusion that it would have been obvious to substitute the Warnick nitric oxide detector for the Eads sulfur dioxide detector in the Eads system. *ACS Hosp. Sys.*, 732 F.2d at 1575-77, 221 USPQ at 931-33. The Eads and Warnick references disclose, at most, that one skilled in the art might find it obvious to try the claimed invention. But whether a particular combination might be "obvious to try" is not a legitimate test of patentability. *In re Geiger*, 815 F.2d 868, 688, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987); *In re Goodwin*, 576 F.2d 375, 377, 198 USPQ 1, 3 (CCPA 1978).

[2] Obviousness is tested by "what the combined teachings of the references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). But it "cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." *ACS Hosp. Sys.*, 732 F.2d at 1577, 221 USPQ at 933. And "teachings of references can be combined *only* if there is some suggestion or incentive to do so." *Id.* Here, the prior art contains none.

Instead, the Examiner relies on hindsight in reaching his obviousness determination.

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But this court has said, "To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *W. L. Gore*, 721 F.2d at 1553, 220 USPQ at 312-13. It is essential that "the decisionmaker forget what he or she has been taught at trial about the claimed invention and cast the mind back to the time the invention was made . . . to occupy the mind of one skilled in the art who is presented only with the references, and who is normally guided by the then-accepted wisdom in the art." *Id.* One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.

C. Advantage Not Appreciated by the Prior Art .

[3] The Board erred not only in improperly combining the Eads and Warnick references but also in

failing to appreciate that the appealed claims can be distinguished over that combination. A material limitation of the claimed system is that the conversion to nitric oxide occur in the range of 600°C to 1700°C. The purpose of this limitation is to prevent nitrogen from other sources, such as the air, from being converted to nitric oxide and thereby distorting the measurement of nitric oxide derived from the nitrogen compounds of the sample.

The claimed nitric oxide conversion temperature is not disclosed in Warnick. Although Eads describes a preferred temperature of 675°C to 725°C, the purpose of this range is different from that of Fine. Eads requires the 675°C to 725°C range because it affords a temperature low enough to avoid formation of unwanted sulfur trioxide, yet high enough to avoid formation of unwanted sulfides. Fine's temperature range, in contrast, does not seek to avoid the formation of sulfur compounds or even nitrogen compounds. It enables the system to break down the nitrogen compounds of the sample while avoiding the destruction of background nitrogen gas. There is a partial overlap, of course, but this is mere happenstance. Because the purposes of the two temperature ranges are entirely unrelated, Eads does not teach use of the claimed range. See *In re Geiger*, 815 F.2d at 688, 2 USPQ2d at 1278. The Board erred by concluding otherwise.

D. Unexpected Results .

Because we reverse for failure to establish a *prima facie* case of obviousness, we need not reach Fine's contention that the Board failed to accord proper weight to the objective evidence of unexpected superior results. *Id.*

E. The "Flame" Claims .

[4] Claims 62, 68, 69, 79, 85 and 86 relate to the oxygen-rich flame conversion means of the claimed invention. These "flame" claims depend from either apparatus claim 60 or method claim 77. Dependent claims are nonobvious under section 103 if the independent claims from which they depend are nonobvious. *Hartness Int'l, Inc. v. Simplimatic Eng'g Co.*, 819 F.2d 1100, 1108, 2 USPQ2d 1826, 1831 (Fed. Cir. 1987); *In re Abele*, 684 F.2d 902, 910, 214 USPQ 682, 689 (CCPA 1982); see also *In re Sernaker*, 702 F.2d 989, 991, 217 USPQ 1, 3 (Fed. Cir. 1983). In view of our conclusion that claims 60 and 77 are nonobvious, the dependent "flame" claims are also patentable.

Conclusion

The Board's decision affirming the Examiner's rejection of claims 60, 62, 63, 68, 69, 77, 79, 80, 85 and 86 of Fine's application as unpatentable over the prior art under 35 U.S.C. §103 is **REVERSED**.

Footnotes

Footnote *. The Solicitor argues that the contents of Attachment C of Fine's brief were not before the Board and may not properly be considered here. However, we need not rely on Attachment C. It is merely illustrative of the qualitative separation of nitrogen compounds which occurs in Fine's system. The fact that the various constituents exit at discrete intervals is shown by the specification which was before the Board and which may appropriately be considered on appeal. See, e.g., *Astra-Sjuco, A.B. v. United States Int'l Trade Comm'n*, 629 F.2d 682, 686, 207 USPQ 1, 5 (CCPA 1980) (claims must be construed in light of specification).

Dissenting Opinion Text

Dissent By:

Smith, circuit judge, dissenting.

I respectfully dissent. I am of the firm belief that the prior art references, relied upon by the PTO to establish its *prima facie* case of obviousness, in combination teach and suggest Fine's invention to one

skilled in the art. Also, I firmly believe that Fine failed to rebut the PTO's prima facie case. On this basis, I would affirm the board's determination sustaining the examiner's rejection, pursuant to 35 U.S.C. §103, of Fine's claims on appeal before this court.

- End of Case -

ISSN 1526-8535

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FULL TEXT OF CASES (USPQ2D)

All Other Cases

Ralston Purina Company v. Far-Mar-Co., Inc. (CA FC) 227 USPQ 177 (9/19/1985)

Ralston Purina Company v. Far-Mar-Co., Inc. (CA FC) 227 USPQ 177

Ralston Purina Company v. Far-Mar-Co., Inc.**U.S. Court of Appeals Federal Circuit**
227 USPQ 177Decided September 19, 1985
No. 84-1237**Headnotes****JUDICIAL PRACTICE AND PROCEDURE****1. Procedure -- Burden of proof (§ 410.35)**

Party asserting invalidity under 35 USC 112 has initial procedural burden of going forward to establish legally sufficient prima facie case, and, if such burden is met, party relying on validity must then come forward with evidence to contrary, and court, after considering all evidence, must determine whether challenger carried burden of persuasion by clear and convincing evidence.

2. Infringement -- Willful (§ 120.16)

Trial court's finding of willful infringement by accused infringer who was put on notice of patentee's claim by patentee's offer of license and who responded without consulting patent counsel, is not clearly erroneous, despite accused's claim that patentee withdrew offer too quickly for accused to "develop" willfulness.

Particular patents -- Protein Product

No 3,940,495, Flier, Protein Product and Method for Forming Same, Claims 1-9, 14, 19, 27-31, and 33-52, invalid, Claims 10-13, 15-18, 20-26, and 32, not invalid, and Claims 10-13, 15-18, 20, 22, 23, and 32, infringed.

Case History and Disposition:

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Appeal from District Court for the District of Kansas; Crow, J.

Action by Ralston Purina Company, against Far-Mar-Co., Inc., for patent infringement. From judgment defendant appeals. Affirmed in part and reversed in part.

Attorneys:

Warren N. Williams and Schmidt, Johnson, Hovey & Williams, both of Kansas City, Mo. (John M. Collins, on the brief) for appellant.

Randall G. Litton and Price, Heneveld, Huizenga & Cooper, both of Grand Rapids, Mich. (Richard C. Cooper, on the brief) for appellee.

Judge:

Before Baldwin and Bennett, Circuit Judges, and Miller, Senior Circuit Judge 1.

Opinion Text**Opinion By:**

Baldwin, Circuit Judge.

The decision of the United States District Court for the District of Kansas, holding claims 1-52 of U.S. Patent No. 3,940,495 (Flier) not invalid, and holding claims 1, 2, 8-20, 22, 23, 25, and 29-33 willfully infringed, is affirmed-in-part and reversed-in-part.

Facts

The Flier invention is the first successful process, and resultant product, for directly and continuously restructuring oil seed particles, preferably soy particles, into a textured, chewable, fibrous, meat-like food product. Restructuring is accomplished by mechanically working defatted, moistened soy particles under elevated temperature and pressure, into a flowable, plastic mass which is expanded into the restructured, fibrous, meatlike food product by suddenly releasing the pressure. The original application was filed July 10, 1964. A continued-in-part application was filed December 9, 1966. A continuation application was filed January 17, 1973, from which the patent issued. Although the 1964 application is more properly called a grandparent application, it will be referred to as the parent for the purposes of this opinion.

Interference 96,355, styled *Wilding v. Flier v. Atkinson*, was declared on May 23, 1968, involving the pending patent applications of Morris Wilding (assignor to Swift and Co.), Flier (assignor to Ralston Purina Co. (Ralston)) and William T. Atkinson (assignor to Archer-Daniels-Midland Co. (ADM)). Priority was eventually awarded to Flier on August 13, 1971. The interference was appealed, but settled by a cross-licensing arrangement on April 6, 1972. The settlement agreement provided that each party would grant to any third party making a written request a nonexclusive license under the claims of any existing or future patent.

On July 9, 1973, counsel for Flier specifically advised the examiner that an ADM patent application (the

Dutch publication), No. 6506477, had been published on November 22, 1965, and that it corresponded generally to the Atkinson United States patent application which had been involved in the interference. The district court found specifically that this reference was brought to the examiner's attention after discovery in June, 1973, and that it was indeed a printed publication.

Claims which correspond to claims 8, 9, and 34-52 in Flier were allowed in an office action issued April 5, 1974. Additional claims were allowed in November 1, 1974. The remaining claims were allowed June 3, 1975.

Far-Mar-Co was licensed by ADM for the product described by the patent in suit. Upon issuance of Flier, Ralston offered a license to

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Far-Mar-Co, which was immediately declined. Ralston filed suit in district court for patent infringement approximately sixty days after Flier issued.

OPINION

The decisive issues in this case are:

1. Whether the trial court erred in deciding that Far-Mar-Co's burden of proof was to show by clear and convincing evidence that Flier was invalid.
2. Whether the trial court clearly erred in finding that the patent application of Archer Daniels Midland Company, No. 6506477 filed in the Patent Office of the Netherlands (Dutch publication) did not anticipate the claims of Flier.
3. Whether the trial court's finding that claims 10-13, 15-28, and 32 were descriptively supported by the parent application and thus entitled to the parent's 1964 filing date is clearly erroneous.
4. Whether the trial court's finding of willful infringement was clearly erroneous.

Burden of Proof

Far-Mar-Co contends that the district court erroneously imposed upon it the burden of proving insufficient disclosure in the parent application; also, that Ralston, as the party asserting adequate disclosure, should have borne the burden of demonstrating that adequate legal support exists. Ralston, on the other hand, argues that the district court correctly placed the burden of overcoming the presumption of validity by demonstrating insufficiency of disclosure of Far-Mar-Co, and found that Far-Mar-Co had not shown by clear and convincing evidence that it had met that burden.

[1] Far-Mar-Co incorrectly treats the burden of establishing a *prima facie* case of insufficiency of disclosure as if it bears no relationship to the burden of overcoming the presumption of validity accorded a patent under 35 U.S.C. § 282. A patent is presumed valid, and the burden of persuasion to the contrary is and remains on the party asserting invalidity. *W. L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 313 (Fed. Cir. 1983), *cert. denied*, 105 S.Ct. 172 (1984). In addition, the party asserting invalidity also bears the initial procedural burden of going forward to establish a legally sufficient *prima facie* case of invalidity. If this burden is met, the party relying on validity is then obligated to come forward with evidence to the contrary. Before rendering its judgment, the court must determine whether "all of the evidence establishes that the validity challenger so carried his burden as to have persuaded the decisionmaker that the patent can no longer be accepted as valid." *Lear Siegler, Inc. v. Aeroquip Corp.*, 733 F.2d 881, 885, 221 USPQ 1025, 1028 (Fed. Cir. 1984). A party asserting invalidity based on 35 U.S.C. § 112 bears no less a burden and no fewer responsibilities than any other patent challenger. Far-Mar-Co's burden of proof before the district court was to show by clear and convincing evidence that Flier was invalid. *See, e.g., Pennwalt Corp. v. Akzona, Inc.*, 740 F.2d 1573, 1578, 222 USPQ 833, 836 (Fed. Cir. 1984). The district court recognized and enunciated these rules. Accordingly, we hold that it did not place an impermissible burden upon Far-Mar-Co. 2 The question of whether disclosure satisfies the written description requirement of § 112 is based on questions of fact. *See In re Wilder*, 736 F.2d 1516, 1520, 222 USPQ 369, 372 (Fed. Cir. 1984), *cert. denied*, 105 S.Ct. 1173 (1985). Far-Mar-Co thus bears the burden of demonstrating that the court erred

in its application of the law to the facts, *See Bose Corp. v. Consumers Union*, 466 U.S. 485, 104 S.Ct. 1949 (1984), or that its findings of fact were clearly erroneous.

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Anticipation

Anticipation is a factual determination, reviewable under the "clearly erroneous" standard. *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1458, 221 USPQ 481, 485 (Fed. Cir. 1984). A finding is "clearly erroneous" when although there is evidence to support it, the reviewing court on the entire evidence is left with the definite and firm conviction that a mistake has been committed. *United States v. U.S. Gypsum Co.*, 333 U.S. 364, 395, 76 USPQ 430, 444 (1948); *SSIH Equipment S.A. v. USITC*, 718 F.2d 365, 381, 218 USPQ 678, 692 (Fed. Cir. 1983). Anticipation requires that "all limitations of the claim are found in the reference, or 'fully met' by it." *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 772, 218 USPQ 781, 789 (Fed. Cir. 1983).

Ralston contends, and the trial court found, that the Dutch publication was deficient because it failed to disclose (1) the importance of a "minor amount of fat" present during extrusion; (2) a definition for the word "plexilamellar" which was used to describe the product; and (3) the desirability of "separate zones of confinement or orifices" in the machinery used to mix and extrude the product. These findings are clearly erroneous.

The first finding is clearly erroneous because the Dutch publication specifies the same starting material claimed in Flier, and the trade defines the starting material as having low levels of fat. The publication is therefore not deficient as to this element of Flier's claims.

The second finding, that the Dutch publication does not define "plexilamellar" is unsupportable in view of the following passage from page 2 of that publication:

The protein extrudate obtained according to the above mentioned method is a rough, resilient, dry to slightly moist to the touch, open celled foamy mass made up of interlaced interconnected strips of varying width and thickness which may appear fibrous or skin-like. The majority of the cells formed by this *plexilamellar* protein structure are [Emphasis added.]

The third finding is similar to the first, and fails for a similar reason. The Dutch publication discloses the use of a standard extruder which, at the time, came equipped with the structure specified in the Flier patent. The publication is therefore not deficient as to this element of Flier's claims.

As a result of our disposition of this issue, only those claims entitled to the effective filing date, July 10, 1964, of the parent application remain in issue. The trial court held and Ralston does not contest, that claims 1-9, 14, 29-31, and 33-52 were entitled only to the effective filing date of the 1966 application. Thus, we hold these claims to be invalid for having been described in a printed publication before the invention thereof by the applicant for patent. 35 U.S.C. § 102(a).

Description Requirement

The trial court held that claims 10-13, 15-28, and 32 of Flier are entitled to the effective filing date of the 1964 parent application because the parent application complies with the written description requirement of 35 U.S.C. § 112, first paragraph, which is incorporated in 35 U.S.C. § 120. Whether the description requirement is met is a question of fact reviewable under the clearly erroneous standard. *In re Wilder*, 736 F.2d 1516, 1520, 222 USPQ 369, 372 (Fed. Cir. 1984), *cert. denied*, 105 S.Ct. 1173 (1985). The trial court properly recognized that the test for sufficiency of support in a parent application is whether the disclosure of the application relied upon "reasonably conveys to the artisan that the inventor had possession at that time of the later claimed subject matter." *In re Kaslow*, 707 F.2d 1366, 1375, 217 USPQ 1089, 1096 (Fed. Cir. 1983). Precisely how close the original description must come to comply with the description requirement of 35 U.S.C. § 112 must be determined on a case-by-case basis. *In re Wilder*, 736 F.2d 1516, 1520, 222 USPQ 369, 372 (Fed. Cir. 1984).

Far-Mar-Co cites several range cases to support its argument that ranges found in the applicant's claim

language must correspond exactly to ranges disclosed in the parent. These cases are not in point. The facts in these cases precluded a determination that one skilled in the art could derive the claim limitations from the parent, due to a number of different factors, e.g., the unpredictable nature of the art, *In re Sichert*, 566 F.2d 1154, 196 USPQ 209 (CCPA 1977); failure to distinguish one process from another, *In re MacLean*, 454 F.2d 756, 172 USPQ 494 (CCPA 1972); the addition of a critical limitation, *In re Blaser*, 556 F.2d 534, 194 USPQ 122 (CCPA 1977); failure to define a critical term, *In re Lukach*, 442 F.2d 967, 169 USPQ 795 (CCPA 1971); and use of a list that did not contain the claimed substance. *In re Ahlbrecht*, 435 F.2d 908, 168 USPQ 293 (CCPA 1971). In addition, a predecessor to this court has held "that a claim may be broader than the specific embodiment disclosed in a specification is in itself of no moment." *In re Rasmussen*, 650 F.2d 1212, 1215, 211 USPQ 323, 326 (CCPA 1981). Far-Mar-Co argues that the claims

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remaining in issue contain new matter at least with respect to the protein content of the starting material, total and added moisture, temperature ranges, and the situs of fiber formation. Far-Mar-Co contends that although the 1964 parent application would enable one skilled in the art to practice the invention claimed, it does not meet the description requirement under 35 U.S.C. § 112.

With respect to protein content, Far-Mar-Co argues that the claim language "protein content of at least about that of solvent extracted soybean meal" is not supported by the language of the parent application, which speaks of "soybean meal having a low fat and high protein content." The parent application also states that "[s]uch 50% protein soybean meal is well known and frequently is a by-product of the process of oil extraction from soybeans. Such meal is preferably solvent extracted to decrease the fat content thereof to the range mentioned above." Further, "[s]oybean meal having a protein content of approximately 50% is the preferred meal component for use in the present invention. When, however, the meal has a protein content of substantially less than 50%, it may be mixed with a high protein component which will increase the protein content of the combination to the preferred 50%."

The trial court found that the parent disclosure does support the claim language, based on the 1964 disclosure and on consideration of the knowledge possessed by those skilled in the art of extrusion of both farinaceous and proteinaceous vegetable materials in 1964. The trial court found that soybean meal of 44%, 50%, 70%, and 90% protein were standard, available commodities in 1964. The trial court also found that the parent, which disclosed a "high protein content" and a preferred lower level but no upper limit, and indicated that protein content could be adjusted, reasonably conveyed adjustment of the protein content of soybean meal to levels above 50%. Having considered Far-Mar-Co's arguments, we conclude that the court did not clearly err in determining that the parent's disclosure adequately supports the protein content of the claims in issue.

With respect to temperature, Far-Mar-Co argues that the claim limitation "in excess of 212° F" and "substantially above 212° F" are not supported by the parent application. The trial court found that experts from both parties were in substantial agreement that the parent application sets the critical lower limit for temperature at 212° F and supports this limit in the patent claims. The trial court considered evidence of what the skilled artisan would appreciate about the sources of heat in the process, both steam heat and pressure brought to bear on the mixture, as well as the limitations of the equipment disclosed. The trial court also noted that Far-Mar-Co's expert agreed that the claim language calling for the temperature "being increased substantially" found support in the parent application. On the basis of this record, it was not clear error for the court to find sufficient disclosure in the parent application for the above-mentioned limitations.

Far-Mar-Co argues that the trial court clearly erred in finding support in the parent for the moisture content limitations. The trial court considered (1) evidence that the purpose of moisture in the mix was to make the material flow through the extruder; (2) the physical characteristics of mixtures with varying levels of water; (3) the type of test and degree of accuracy in testing for moisture level; and (4) the approximate amount of moisture known by those skilled in the art to be contained in soybean meal.

Based on this evidence and the formulations disclosed in the parent application, the court allowed both parties to calculate approximate upper and lower moisture limits supportable by the parent application. It found inadequate descriptive support in the parent application for the moisture limitations of "at least about 20%" and of those claims calling for a total moisture content "between about 20% and 40% by weight," and the parties do not contest these findings. The court found adequate support for moisture levels of "at least about 25% by weight," "at least 25% by weight," and "in the range of 20-30% of the resulting mixture." The trial court noted that claims simply calling for sufficient water to permit the resulting mixture to be passed through an extruder or calling for approximately 25% of the mixture were not challenged. The trial court's rationale for striking down the claims with endpoints of 20% and 40% was that these limits could not be justified solely by the so-called ball test for moisture content. Those claims would convey new information to one skilled in the art. The open-ended claims, however, would be limited by what a person skilled in the art would understand to be workable. After careful consideration of Far-Mar-Co's arguments, we conclude that the court did not clearly err in determining that the parent's disclosure adequately supported the water ranges of "at least about 25% by weight," and "at least 25% by weight." The court, however, did clearly err in finding support in the parent for the limitation: "in the range of 20%-30% of the resulting mixture" contained in claims 19, 27, and 28. We hold these claims are entitled only to the effective filing date of the 1966 application and are therefore invalid for having been anticipated by the Dutch publication.

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Far-Mar-Co's argument that the parent application requires fiber formation inside the extruder is adequately disposed of by the trial court's opinion. In sum we conclude that claims 10-13, 15-18, 20-26, and 32 of the Flier patent are entitled to the effective filing date of the 1964 parent application because the parent application adequately supports those claims for purposes of 35 U.S.C. § 120.

Willful Infringement

A finding of willful infringement is a question of fact and is not reversible upon appeal unless shown to be clearly erroneous. *Underwater Devices, Inc. v. Morrison-Knudsen Co.*, 717 F.2d 1380, 1389, 219 USPQ 569, 576 (Fed. Cir. 1983). Far-Mar-Co has failed to persuade us that the district court's finding is clearly erroneous.

[2] The trial court found willful infringement based on Far-Mar-Co's "conduct after issuance of the patent, particularly the decision to respond to plaintiff's offer of a license without consulting patent counsel." When a potential infringer has actual notice of another's patent rights, he has an affirmative duty to exercise due care to determine whether or not he is infringing. *Underwater Devices, Inc. v. Morrison-Knudsen Co.*, 717 F.2d at 1389-90, 219 USPQ at 576. Such an affirmative duty usually includes, inter alia, the duty to seek and obtain competent legal advice from counsel before the initiation of any possible infringing activity. *Id.* See also, *King Instrument Corp. v. Otari Corp.*, 767 F.2d 853, 867, 226 USPQ 402, 412 (Slip op. pp. 31-32, June 26, 1985). The offering of a license is actual notice. *Leinhoff v. Louis Milona & Sons, Inc.*, 726 F.2d 734, 743, 220 USPQ 845, 851 (Fed. Cir. 1984). Far-Mar-Co's argument that it did not infringe willfully because Ralston withdrew its offer too quickly is unpersuasive. There is evidence of record that Far-Mar-Co has known of its potential infringement liability to Ralston since 1970. At that time, Ralston was involved in an interference proceeding with other parties, one of whom was Far-Mar-Co's licensor. Far-Mar-Co received notice that Ralston won the interference in April, 1972. After the Ralston patent issued in 1976, Far-Mar-Co rejected a license offer without even consulting its own in-house patent counsel. Far-Mar-Co cites no precedent for a decision that an infringer must be allowed a certain amount of time to "develop" willfulness, and we will not supply it. On the basis of this record, we cannot say the court clearly erred in its finding. Accordingly, we agree with the district court's decision that claims 10-13, 15-18, 20-26, and 32 of the Flier patent have not been shown to be invalid. We *affirm* the holding of infringement of claims 10-13,

15-18, 20, 22, 23, and 32. We hold claims 1-9, 14, 19, 27-31, and 33-52 to be invalid. Finally, we *affirm* the finding of willful infringement.

AFFIRMED-IN-PART AND REVERSED-IN-PART.

Footnotes

Footnote 2. Far-Mar-Co's reliance on *Wagoner v. Barger*, 463 F.2d 1377, 175 USPQ 85 (CCPA 1972), explains the vehemency with which it contends that the district court erred in assigning the burden of proof. *Wagoner* involved an interference in which the senior party owned the patent whose claims were copied to provoke the interference. With respect to the burden of proof on the issue of inherency, the court stated that "[c]learly, the burden of proving that language contained in the claims of the later application [which, in this case, were allowed to issue] is on the party asserting the equivalency. . . and the burden is a heavy one." 463 F.2d at 1380, 175 USPQ at 86-87. This distinguishing feature between *Wagoner* and the present case is that *Wagoner* was an *interference*. Although the *test* for the adequacy of disclosure is the same, whether or not the proceedings are *ex parte* or *inter partes* before the Patent and Trademark Office, or before a district court, the burdens are allocated somewhat differently in each, due to their distinctive characteristics. The objective of an interference, unlike that in a district court when invalidity is alleged, is to determine priority of invention. After being accorded senior or junior party status, with the concomitant procedural benefits (senior party) or burdens (junior party), *each* party is responsible for establishing its case for sufficiency of disclosure in a prior application if it attempts to antedate a reference under § § 112 and 120 or 119. Hence, the rule enunciated in *Wagoner*, 463 F.2d at 1380.

Concurring/Dissenting Opinion Text

Concurrence/Dissent By:

Miller, Senior Circuit Judge, dissenting in part and concurring in part.

I cannot agree with the section in the majority opinion concerning the "written description" requirements of 35 U.S.C. § 112, first paragraph with respect to claims 10-13, 15-28, and 32.

It is necessary that Flier be entitled to its grandparent application's filing date under 35 U.S.C. § 120 if it is to avoid the invalidating effect of the ADM anticipating reference under 35 U.S.C. § 102(a). To be entitled to the benefit of the date of a previously filed co-pending application under section 120, such application must contain a written description of the invention claimed, and of the manner and process of making and using it, as set forth in the later application to comply with the first paragraph of section 112.

The invention claimed in the later application does not have to be described in the prior application *in ipso verbis* in order to satisfy the description requirement of section 112. *Martin v. Johnson*, 454 F.2d 746, 751, 172 USPQ 391, 395 (CCPA 1972); *see Case v. CPC International, Inc.*, 730 F.2d 745, 751, 221 USPQ 196, 201 (Fed. Cir.), *cert. denied*, 105 S.Ct. 223, 224 USPQ 736 (1984). However, claims with no explicit disclosure must find inherent support in the prior application, *Pingree v. Hull*, 518 F.2d 624, 186 USPQ 248 (CCPA 1975); and one skilled in the art, *following the teaching* of the prior application must be able to produce the subject matter of the later claims. *In re Magerlein*, 346 F.2d 609, 612, 145 USPQ 683, 685 (CCPA 1965); *In re Nathan*, 328 F.2d 1005, 1008-09, 140 USPQ 601, 604 (CCPA 1964). Thus, the test for determining whether the disclosure complies with the written description of the invention requirement is whether it would have reasonably conveyed to one of ordinary skill that the inventor invented the later-claimed subject matter. *In re Kaslow*, 707 F.2d 1366, 1375, 217 USPQ 1089, 1096 (Fed. Cir. 1983). The "Legal" equivalent of the claim language is

thus the "necessary and only reasonable construction" to be given the disclosure in the parent application by one skilled in the art. *In re Filstrup*, 251 F.2d 850, 853, 116 USPQ 440, 442 (CCPA 1958). The result claimed must "inevitably occur." See *Kooi v. DeWitt*, 546 F.2d 403, 409, 192 USPQ 268, 273 (CCPA 1976); *Pingree*, 518 F.2d at 627, 186 USPQ at 251.

Section 112 does not refer to a mere "support" standard. In *In re Smith*, 458 F.2d 1389, 1394, 173 USPQ 679, 683 (CCPA 1972), the court stated that "[t]he recent cases suggests [sic] a more stringent requirement for a description of the claimed invention than may have been previously applied in cases wherein the issue was framed in terms of 'support' for claimed subject matter." The original disclosure may not be relied upon unless it "constitute[s] a full, clear, concise and exact description . . . of the invention claimed" in the patent to one of ordinary skill. *In re Wertheim*, 646 F.2d 527, 538-39, 209 USPQ 554, 565 (CCPA 1981) ("*Wertheim II*").

The test of adequacy of disclosure is neither anticipation (e.g., *In re Scheiber*, 587 F.2d 59, 199 USPQ 782 (CCPA 1978)) nor obviousness (See, e.g., *In re Piasecki*, 745 F.2d 1468, 1473, 223 USPQ 785, 789 (Fed. Cir. 1984)). Thus, it is not proper under section 112 to require that a person of ordinary skill determine by "extrapolation, interpolation and assumptions" (*Ex parte Eggleston*, 159 USPQ 692, 693 (PTO Bd. App. 1967)) that disclosure in the prior application would achieve a product possessing characteristics of, or operating within the ranges of numerical values set forth in, the later claimed subject matter. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976) ("*Wertheim I*"), later appealed, 646 F.2d 527, 209 USPQ 554 (CCPA 1981).

To carry its burden of demonstrating insufficient disclosure, Far-Mar-Co must show that the grandparent application would not have taught persons skilled in the art that the ranges of each item claimed in the patent claims were Flier's invention. 1

With respect to protein content of the soybean meal, Far-Mar-Co asserts that the requirements in the Flier patent claims for "vegetable material having a protein content of at least about that of solvent-extracted soybean meal" (claims 15-17 and 32) and for "solvent-extracted soybean material having a protein content at least about that of solvent-extracted soybean meal" (claims 18-26) are not inherent in the grandparent specification, since each claim limitation is an open-ended range of up to 100% protein. The grandparent contains the following references to soybean meal protein:

It has been found that Soybean meal having a low fat and *high protein content* may be treated to form the desirable products of the present invention. Preferably the soybean meal has a fat content as low as 0.5% and a *protein content of approximately 50%*. Such *50% protein soybean meal* is well known and frequently is a by-product of the process of oil extraction from soybeans. . . .

....

Example 1 As a specific example, 17 pounds of 50% soybean meal having a protein content of 50%, a fat content of. . . .

Example 2

....

Soybean meal having a protein content of approximately 50% is the preferred meal component for use in practicing the present invention. *When, however, the meal has a protein content of substantially less than 50%*, it may be mixed with a high protein component which will *increase the protein content of the combination to the preferred 50%*.

(Emphasis supplied.) The district court noted that most of the references to protein concentrations in the grandparent application emphasize the importance of "approximately" 50% protein soybean meal. It also found that in Example 2 of the grandparent indicates that soybean meal lacking sufficient protein concentration may be altered to produce the preferred percentage.

The court also referred to the Soybean Blue Book for 1964 and the Yearbook and Trading Rules for 1964-1965, in which it found reflected the knowledge in the art that the protein content of 50% solvent-extracted soybean meal was "minimum 50%" and that 44% soybean meal was also available. The court also noted that soybean protein concentrate and soybean protein isolate (not soybean meal as the majority opinion suggests), with protein concentrations over 50%, were "well known" in the art in 1964.

I am persuaded that the district court erred when it found from these references (in combination with the grandparent specification disclosure of "about 50% and "approximately 50%" protein) that "[i]t is doubtful that a person skilled in the art would . . . have construed from the parents [*sic*] disclosure a maximum protein limit of about 50%." (Finding 139.) By assuming that those of ordinary

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skill in 1964 would have had additional reference materials for use in creating limitations in the grandparent specification, the court erroneously applied an obviousness analysis, transgressing this court's declaration in *Piasecki*, 745 F.2d at 1473, 223 USPQ at 789 and *In re Shetty*, 566 F.2d 81, 86, 195 USPQ 753, 756 (CCPA 1977), *reh'g denied* (Jan. 19, 1978), that the specification itself must be the source of its interpretation (with respect to scope) for one of ordinary skill. *In re Ruschig*, 379 F.2d 990, 995-96, 154 USPQ 118, 123 (CCPA 1967).

The district court also found that "[a]djustment of the protein content of soybean meal to a level above 50% is reasonably conveyed where the disclosure set forth a requirement of a 'high protein content,' disclosed the preferred level but no upper limit. . . ." By taking this language out of context, the court erred in its interpretation of the specification. The language should have been read *in pari materia* with the sentence that follows it, which clearly indicates that Flier equated "high protein content" with "approximately 50%." I disagree with the gloss imposed on the language of the grandparent application by the majority opinion. The *patent* claim language is not the only "*necessary and reasonable*" construction of the language in the grandparent application (*In re Filstrup*, 251 F.2d at 853, 116 USPQ at 442), and a "level above 50%" is not the "inevitable" interpretation of "about," "approximately," or even "preferably" 50%. *Cf. Kropa v. Robie*, 187 F.2d 150, 154-55, 88 USPQ 478, 483 (CCPA 1951). The district court conceded that the "open-ended range of from about 50% to 100% is "in part predicated on the assumption that solvent-extracted soybean meal contains about 50% protein." If this means, as the majority asserts, that the district court found that the grandparent application discloses a "preferred lower limit," such finding is clearly erroneous. The grandparent application does state that 50% protein meal was the preferred concentration. However, in view of the language in the grandparent application expressing Flier's knowledge that "substantially less than 50% protein was a class of protein concentrations known to him at that time (which concentrations were readily raised to the preferred 50%), I cannot agree that the grandparent taught 50% protein concentration as a "preferred lower limit." Rather, if "preferred" is to be interpreted as a limitation, the more reasonable construction in this case would be as an upper limit. I conclude that the district court erred in finding that the Flier patent claims containing limitations on protein content of soybean meal were sufficiently disclosed in the 1964 grandparent application.

With respect to moisture content, Far-Mar-Co contends that the district court erred in concluding that the Flier claims limitations were sufficiently disclosed in the grandparent application. The 1964 grandparent recites, in the examples, 17 pounds of soybean meal "mixed with 2600 cc. of water" or 2850 cc. (It is undisputed that 2600 and 2850 cc. are 25 and 27% by weight, respectively, of the mixtures recited in the examples.) The claims limitations refer to "at least about 25% by weight" (claims 10-13) and "at least 25% by weight" (claims 15-17, 32).

These findings by the district court suffer from the same infirmities as do those with respect to protein concentration. Although written disclosure cases must be determined on a case-by-case basis (*e.g.*, *In re Driscoll*, 562 F.2d 1245, 1250, 195 USPQ 434, 438 (CCPA 1977)) *Wertheim I, supra*, opposes extending, without limitation, the range of the only examples stated in the prior application in a situation similar to the present claims 10-13, 15-17, and 32. *See In re Ahlbrecht*, 435 F.2d 908, 168 USPQ (CCPA 1971); *Smith*, 458 F.2d at 1394-95, 173 USPQ at 683 (disclosure of genus and one species not sufficient description of intermediate subgenus). Certainly, genera and subgenera ranges which substantially deviate from the two species disclosed in the grandparent are not sufficiently described when there is no suggestion to those skilled in the art that such ranges of moisture are embraced by the original invention.

In reaching its conclusions, the district court relied on (1) "the practice" at Ralston in 1964, (2) "squeeze test," and (3) knowledge of those skilled in the art of the moisture content of soybean meal. It should be pointed out that "the practice" at Ralston in 1964 does not even appear to be within the knowledge of one of ordinary skill, and neither a "squeeze test" nor the importance of the moisture content of soybean meal is suggested in the grandparent application. *Cf. In re Salmon*, 705 F.2d 1579, 1581, 217 USPQ 981, 983 (Fed. Cir. 1983); *Wertheim I*, 541 F.2d at 267-68, 191 USPQ at 101. I am persuaded that the district court's findings on moisture content limitations are clearly erroneous.

Far-Mar-Co also contests the findings of the district court on the issue of the range of processing temperatures. The 1964 application recites a range of 212-360° F in one example and states elsewhere that the mixture "must be subjected to heat . . . during the extrusion process." The Flier patent claims recite "in excess of 212° F" (claim 10) and "substantially above 212° F" (claims 11-13, 15-16, 28, and 32). These findings of the court are subject to the same criticism as are those

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relating to moisture content. The reasoning in *Wertheim I*, *Ahlbrecht*, and *Smith* applies to the limitations in claims 10, 15-16, 28, and 32. "[I]nto the range of 212-310° F" (claim 27) requires further discussion, because this range is totally within the range explicitly disclosed in the grandparent. The court in *Wertheim II* held that the disclosure in the parent of 25% to 60% solids content, without more, did not satisfy the description requirement of the later claimed 35% to 60% solids concentration, because the claimed range was a significant restriction on the invention. 646 F.2d at 538, 209 USPQ at 565. Analogous is claim 27, in which Ralston attempts to rely upon the grandparent's disclosure of 212-380° F. Although it is likely, as the district court states, that "the skilled artisan would observe a practical upper limit of avoiding burning or scorching material passing through the extruder" (Finding 151), the ADM reference indicates that extrusion temperatures of 450°F were feasible in 1965. Without any suggestion in the grandparent that temperatures above 310° F would damage the product, there is no "inevitable" or "necessary and only reasonable construction" of the grandparent's disclosure as having the upper limit of 310° F in claim 27. *Cf. In re Salmon*, 705 F.2d at 1581, 217 USPQ at 983.

Finally, on the issue of situs of fiber formation (claims 10-13, 15-28, and 32), I concur with the majority opinion that Far-Mar-Co has not demonstrated that the district court clearly erred. Although Flier did not know in 1964 where fiber formation occurred, I am persuaded that one of ordinary skill in the art would have been taught by the grandparent disclosure how the invention was practiced. *See Spero v. Ringold*, 377 F.2d 652, 656, 153 USPQ 726, 728-29 (CCPA 1967); *In re Magerlein*, 346 F.2d at 611-12, 145 USPQ at 685. The invention "may well [have been] disclosed without positive identification." *Petisi v. Rennhard*, 363 F.2d 903, 907, 150 USPQ 669, 672 (CCPA 1966); *see Foss v. Oglesby*, 127 F.2d 312, 317, 53 USPQ 356, 361 (CCPA 1942).

In view of the foregoing, Ralston cannot rely on Flier's 1964 grandparent application for priority under sections 112 and 120 for claims 10-13, 15-28, and 32. Thus, these claims are rendered invalid by the ADM anticipating reference.

I do not join the majority on the issue of willfulness because it is rendered moot in light of my dissent.

Footnotes

Footnote 1. The sufficiency of Far-Mar-Co's *prima facie* case is not at issue, since the district court evidently considered all of the evidence produced by both parties.

Footnote 1. The Honorable Jack P. Miller assumed senior status effective June 6, 1985.

- End of Case -

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ISSN 1526-8535

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June 22, 1983. These two papers, filed before decision, deal only with the printing of the Combined Appendix of ten volumes said to contain a total of 9,307 pages, 5,743 of which were designated by appellee after appellants had initially designated the balance. There is an excessively detailed dispute over how many of the pages designated by appellee were necessary. Appellee appears not to have contributed to the cost of printing the appendix, which cost, paid by appellants, is said to have been \$31,850.15. Federal Rule of Appellate Procedure (FRAP) 30(b) authorizes us to impose upon a party the cost of printing material "unnecessarily" included. FRAP Rule 39(a) provides that, in the absence of an order by the court, in the case of a reversal "costs shall be taxed against the appellee."

Having considered the foregoing, we have a clear appreciation of the impossibility of determining, within reason, exactly what was or was not necessarily included in the appendix in this extended and complex litigation. We conclude that, under all of the circumstances with which we have necessarily become familiar in deciding this case, it is fair and equitable that the parties share equally the cost of printing the Combined Appendix and that otherwise each party bear its own costs. In accordance with Rule 39(a), it is so ordered.

Reversed and Remanded.

Miller, Circuit Judge, concurring in part.

Although I agree with the majority's analysis and holding on the fraud issue, it seems appropriate to state my conclusion that, because of the unpredictability of propanil in 1957, the district court erred in granting R&H an April 4, 1957, date of conception rather than a date, concurrent with a reduction to practice, in the summer of 1957 — after the May 27, 1957, date of filing of Monsanto's application, so that the Monsanto patent constitutes a 35 U.S.C. §102(c) bar to the R&H patent. *Alpert v. Slatin*, 305 F.2d 891, 896, 134 USPQ 296, 301 (CCPA 1962).

Court of Appeals, Federal Circuit

W.L. Gore & Associates, Inc.
v. Garlock, Inc.

Nos. 83-613/614

Decided Nov. 14, 1983

PATENTS

1. Court of Appeals for the Federal Circuit — Weight given decision reviewed (§26.59)

Parties' argument relating to salutary injunction of FRCivP 52(a) cannot be controlling on all issues, where dispositive legal error occurred in interpretation and application of patent statute, 35 USC.

2. Court of Appeals for the Federal Circuit — Weight given decision reviewed (§26.59)

Findings that rest on erroneous view of law may be set aside on that basis.

3. Construction of specification and claims — Claim defines invention (§22.30)

Claims measure and define invention.

4. Construction of specification and claims — Combination claims (§22.35)

Infringement — Process patents (§39.65)

Court's restriction of claimed multi-step process to one step constitutes error, whether done at behest of patentee relying on that restriction to establish infringement by one who employs only that one step in process otherwise distinct, or at behest of accused infringer relying on that restriction to establish invalidity by showing that one step in prior art process otherwise distinct; invention must be considered as whole.

5. Court of Appeals for the Federal Circuit — Weight given decision reviewed (§26.59)

CAFC is not at liberty to substitute its own for district court's findings underlying district court's conclusion that claim is invalid.

6. Patentability — Anticipation — Process (§51.225)

It is irrelevant that those using invention may not have appreciated results where patent owner's operation of device is consistent, reproducible use of claimed invention; were that alone enough to prevent anticipation, it would be possible to obtain patent for old and unchanged process.

7. Use and sale — Extent and character of use (§69.5)

Nonsecret use of claimed process in usual course of producing articles for commercial purposes is public use.

8. Use and sale — Extent and character of use (§69.5)

Patentees' commercialization of product produced by its patented process can result in forfeiture of patent granted them for that process on application filed by them more than one year later; however, their secret commercialization of process cannot be bar to patent grant on that process.

9. Patent grant — Intent of patent laws (§50.15)

Early public disclosure is linchpin of patent system.

10. Interference — Priority (§41.70)

Law disfavors prior inventor who benefits from process by selling its product but suppresses, conceals, or otherwise keeps process from public, as against later inventor who promptly files patent application from which public will gain disclosure of process.

11. Patentability — Evidence of — In general (§51.451)

District court that in its consideration of prior art disregarded unpredictability and unique nature of product to which claimed inventions relate errs.

12. Construction of specification and claims — By prior art (§22.20)

District court that in its consideration of prior art considers claims in less than their entireties errs.

13. Patentability — Evidence of — Suggestions of prior art (§51.469)

District court that considers references in less than their entireties, i.e., in disregarding disclosures in references that diverge from and teach away from invention at hand, errs.

14. Construction of specification and claims — Comparison with other claims (§22.40)

Claims must be considered individually and separately.

15. Patentability — Anticipation — Combining references (§51.205)

There must have been something present in teachings in references to suggest to one skilled in art that claimed invention before court would have been obvious.

16. Patentability — Evidence of — Suggestions of prior art (§51.469)

Fact that patentee proceeded contrary to accepted wisdom of prior art is strong evidence of nonobviousness.

17. Patentability — Tests of — Skill of art (§51.707)

Imbuing one of ordinary skill in art with knowledge of invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to insidious effect of hindsight syndrome wherein that which only inventor taught is used against its teacher.

18. Patentability — Invention — In general (§51.501)**Patentability — Tests of — Skill of art (§51.707)**

Decisionmaker must forget what he or she has been taught at trial about claimed invention and cast mind back to time invention was made to occupy mind of one skilled in art who is presented only with references, and who is normally guided by then-accepted wisdom in art.

19. Pleading and practice in courts — Burden of proof — Validity (§53.138)**Presumption for patent grant — Patent Office consideration of prior art (§55.5)**

It is not law that presumption of validity is weakened greatly where Patent Office has failed to consider pertinent prior art; presumption has no separate evidentiary value; it cautions decisionmaker against rush to conclude invalidity; submission of additional art that is merely "pertinent" does not dispel that caution; however, inescapable burden of persuasion on one who would prove invalidity remains throughout trial.

20. Pleading and practice in courts — Burden of proof — Validity (§53.138)**Presumption from patent grant — Patent Office consideration of prior art (§55.5)**

Burden of proving invalidity may be facilitated by prior art that is more pertinent than that considered by PTO.

21. Patentability — Evidence of — In general (§51.451)

District court that specifically declines to consider objective evidence of nonobviousness errs; that evidence can often serve as insur-

ance against insidious attraction of siren hindsight when confronted with difficult task of evaluating prior art; even when prior art evidence points more in direction of nonobviousness than obviousness, objective evidence may tend to reassure decisionmaker.

22. Patentability — Anticipation — In general (§51.201)

Anticipation requires disclosure in single prior art reference of each element of claim under consideration.

23. Patentability — Anticipation — Process (§51.225)

Patentability — Composition of matter (§51.30)

Anticipation of inventions set forth in product claims cannot be predicated on mere conjecture respecting characteristics of products that might result from practice of processes disclosed in references.

24. Patentability — Anticipation — Infringement as test (§51.211)

Accused infringer's employment of process of dominating patent is not anticipation of invention described and claimed in improvement patent.

25. Patentability — Anticipation — In general (§51.201)

Patentability — Invention — In general (§51.501)

Inherency and obviousness are distinct concepts.

26. Patentability — Evidence of — In general (§51.451)

All evidence bearing on obviousness issue, as with any other issue raised in conduct of judicial process, must be considered and evaluated before required legal conclusion is reached.

27. Patentability — Evidence of — In general (§51.451)

Objective evidence of nonobviousness, i.e., "indicia" of *Graham v. John Deere Co.*, 148 USPQ 459, may in given case be entitled to more weight or less, depending on its nature and its relationship to invention's merits; it may be most pertinent, probative, and revealing evidence available to aid in reaching conclusion on obvious/nonobvious issue.

28. Patentability — Evidence of — Commercial success — In general (§51.4551)

Praise greeting products claimed in patent from suppliers, including owner of prior art

patent, is objective evidence of nonobviousness.

29. Patentability — Composition of matter (§51.30)

Claim to new product is not required to include critical limitations.

30. Specification — Sufficiency of disclosure (§62.7)

Patents are written to enable those skilled in art to practice invention, not public, and Section 112 speaks as of application filing date, not as of time of trial.

31. Specification — Sufficiency of disclosure (§62.7)

Section 112 requires that inventor set forth best mode of practicing invention known to him at time application was filed.

32. Claims — Indefinite — In general (§20.551)

Use of "stretching at rate exceeding specific percent per second" in claims is not indefinite.

33. Claims — Specification must support (§20.85)

It is claimed invention for which enablement is required.

34. Specification — Sufficiency of disclosure (§62.7)

Patent is not invalid merely because some experimentation is needed; patent is invalid only when those skilled in art are required to engage in undue experimentation to practice invention.

35. Construction of specification and claims — Claim defines invention (§22.30)

Distinguishing what infringes from what does not is role of claims, not of specification.

36. Construction of specification and claims — Defining terms (§22.45)

Patent applicant can be his own lexicographer.

37. Defenses — Fraud (§30.05)

Fraud must be shown by clear and convincing evidence; state of mind of one making representations is most important of elements to be considered in determining existence of fraud; good faith and subjective intent, while they are to be considered, should not necessarily be made controlling; under ordinary circumstances, fact of misrepresentation coup-

led with proof that party making it had knowledge of its falsity is enough to warrant drawing inference that there was fraudulent intent; where public policy demands complete and accurate disclosure it may suffice to show nothing more than that misrepresentations were made in atmosphere of gross negligence as to their truth.

38. Pleading and practice in courts — Issues determined — Validity and infringement (§53.505)

Better practice is for district court to decide both validity and infringement issues when both are contested at trial, enabling conduct of single appeal and disposition of entire case in single appellate opinion.

39. Infringement — Tests of — Comparison with claim (§39.803)

Infringement is decided with respect to each asserted claim as separate entity.

Particular patents — Porous Products

3,953,566, Gore, Process for Producing Porous Products, holding of invalidity of claims 3 and 19 reversed and of claims 1 and 17 affirmed.

4,187,390, Gore, Porous Products and Process Therefor, holding of invalidity reversed.

Appeal from District Court for the Northern District of Ohio, Manos, J.; 220 USPQ 220.

Consolidated actions by W. L. Gore & Associates, Inc., against Garlock, Inc., for patent infringement, in which defendant counterclaims for declaratory judgment of patent invalidity, noninfringement, fraudulent solicitation, and entitlement to attorney fees. From judgment for defendant, plaintiff appeals and defendant cross-appeals. Affirmed in part, reversed in part, and remanded; Davis, Circuit Judge, concurring in result in part and dissenting in part, with opinion.

David H. Pfeffer, New York, N.Y. (J. Robert Dailey and Janet Dore, both of New York, N.Y., and John S. Campbell, Newark, Del., of counsel) for appellant.

John J. Mackiewicz, Philadelphia, Pa. (Dale M. Heist, Philadelphia, Pa., on the brief, Bernard Ouziel, New York, N.Y., of counsel) for appellee.

Before Markey, Chief Judge, and Davis and Miller, Circuit Judges.

Markey, Chief Judge.

Appeal from a judgment of the District Court for the Northern District of Ohio holding U.S. Patents 3,953,566 ('566) and 4,187,390 ('390) invalid. We affirm in part, reverse in part, and remand for a determination of the infringement issue.

Background

Tape of unsintered polytetrafluorethylene (PTFE) (known by the trademark TEFLON of E.I. du Pont de Nemours, Inc.) had been stretched in small increments. W. L. Gore & Associates, Inc. (Gore), assignee of the patents in suit, experienced a tape breakage problem in the operation of its "401" tape stretching machine. Dr. Robert Gore, Vice President of Gore, developed the invention disclosed and claimed in the '566 and '390 patents in the course of his effort to solve that problem. The 401 machine was disclosed and claimed in Gore's U.S. Patent 3,664,915 ('915) and was the invention of Wilbert L. Gore, Dr. Gore's father. PTFE tape had been sold as thread seal tape, i.e., tape used to keep pipe joints from leaking. The '915 patent, the application for which was filed on October 3, 1969, makes no reference to stretch rate, at 10% per second or otherwise, or to matrix tensile strength in excess of 7,300 psi.

Dr. Gore experimented with heating and stretching of highly crystalline PTFE rods. Despite slow, careful stretching, the rods broke when stretched a relatively small amount. Conventional wisdom in the art taught that breakage could be avoided only by slowing the stretch rate or by decreasing the crystallinity. In late October 1969, Dr. Gore discovered, contrary to that teaching, that stretching the rods as fast as possible enabled him to stretch them to more than ten times their original length with no breakage. Further, though the rod was thus greatly lengthened, its diameter remained virtually unchanged throughout its length. The rapid stretching also transformed the hard, shiny rods into rods of a soft, flexible material.

Gore developed several PTFE products by rapidly stretching highly crystalline PTFE, including: (1) porous film for filters and laminates; (2) fabric laminates of PTFE film bonded to fabric to produce a remarkable material having the contradictory properties of impermeability to liquid water and permeability to water vapor, the material being used to make "breathable" rainwear and filters; (3) porous yarn for weaving and braiding into other products, like space suits and pump packing; (4) tubes used as replacements for human arteries and veins; and (5) insulation for high performance electric cables.

On May 21, 1970, Gore filed the patent application that resulted in the patents in suit. The '566 patent has 24 claims directed to processes for stretching highly crystalline, unsintered, PTFE. The processes, *inter alia*, include the steps of stretching PTFE at a rate above 10% per second and at a temperature between about 35°C and the crystalline melt point of PTFE. The '390 patent has 77 claims directed to various products obtained by processes of the '566 patent.

It is effectively undisputed that the present inventions filled a long sought yet unfilled need. The United States Army and the research director of a Garlock Inc. (Garlock) customer had been looking for and following up every remote lead to a waterproof/breathable material for many years.

It is undisputed that the present inventions enjoyed prompt and remarkable commercial success due to their merits and not to advertising or other extraneous causes.

It is undisputed that the inventions provide the most important synthetic material available for use in vascular surgery, hundreds of thousands of persons having received artificial arteries formed of the patented products since 1976, and that the patented products have unique properties useful in other medical procedures, in communications satellites, radar systems, and electrical applications.

It is undisputed that the major sources of PTFE, ICI and du Pont, greeted the patented products as "magical," "bewitching," "a remarkable new material," and one that "differs from other processed forms of Teflon."

It is undisputed that the patented products were met with skepticism and disbelief by at least one scientist who had worked with PTFE at du Pont for many years and who testified as an expert at trial.

It is undisputed that Garlock first produced an accused product in response to a customer's request for a substitute for the patented product, that Garlock advertised its accused product as a "new form" of PTFE and as "a versatile new material which provides new orders of performance for consumer, industrial, medical and electrical applications," and that the customer describes that accused product as "a new dimension in rainproof/breathable fabrics."

Proceedings

On Nov. 2, 1979, Gore sued Garlock for infringement of process claims 3 and 19 of the '566 patent, and sought injunctive relief, damages and attorney fees. Garlock counter-claimed on Dec. 18, 1979, for a declaratory judgment of patent invalidity, non-infringe-

ment, fraudulent solicitation, and entitlement to attorney fees. On Feb. 7, 1980, Gore filed a second suit for infringement of product claims 14, 18, 36, 43, 67 and 77 of the '390 patent. In light of a stipulation, the district court consolidated the two suits for trial.

Gore alleged infringement of certain claims by certain products:

'566 patent claims	'390 patent claims	Garlock Product
19	14,43	film
--	36,77	laminate
19	18	yarn
--	67	braided packing
3	--	tape

At trial, Garlock addressed only claims 1, 3, 17, and 19 of the '566 patent and claims 1, 9, 12, 14, 18, 35, 36, 43, 67 and 77 of the '390 patent. See Appendix to this opinion.

The district court, in a thorough memorandum accompanying its judgment, and in respect of the '566 patent: (1) found claim 1 anticipated under 35 U.S.C. §102(a) by Gore's use of its 401 machine and use by the Budd Company (Budd) of a Cropper machine; (2) declared all claims of the patent invalid under 102(b) because the invention had been in public use and on sale more than one year before Gore's patent application, as evidenced by Budd's use of the Cropper machine; (3) held claims 1, 3, 17 and 19 invalid for obviousness under 35 U.S.C. §103, on the basis of various reference pairings: (a) Japanese patent 13560/67 (Sumitomo) with U.S. patent 3,214,503 (Markwood); (b) U.S. patent 2,776,465 (Smith) with Markwood; or (c) Gore's '915 patent with Sumitomo; and (4) held all claims invalid as indefinite under 35 U.S.C. §112.¹

¹ 35 U.S.C. §102(a) and (b) provide:

A person shall be entitled to a patent unless —

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or * * *

35 U.S.C. §103 provides:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

In its opinion respecting the '390 patent, the district court held: (1) claims 1, 9, 12, 14, 18, 35, 36, 43, 67 and 77 invalid §§102 and 103 in view of Sumitomo and Smith; and (2) all claims invalid as indefinite under §112.

The court found that Gore did not commit fraud before the Patent and Trademark Office (PTO), denied Garlock's request for attorney fees, and refrained from deciding the infringement issue.

Issues

Did the district court err in: (1) its holding of invalidity under §§102(a), 102(b), 103 and 112; (2) its finding that Gore did not commit fraud on the PTO; or (3) denying attorney fees.

Opinion

This hard fought and bitterly contested case involved over two years of discovery, five weeks of trial, the testimony of 35 witnesses (19 live, 16 by deposition), and over 300 exhibits. The district court issued an exhaustive 37-page memorandum opinion, reflective of a careful, conscientious approach to the determination of the many issues presented at trial.

The record on appeal consists of 2000 pages. The parties' briefs total 199 pages. In those briefs, counsel repeatedly accuse each other of numerous and serious breaches of the duty of candor owed the court. Each cites instances in which the testimony, the findings, and the record are or are said to be quoted in part and out of context. As a result, the usefulness and reliability of the briefs as means of informing the court has been greatly diminished if not destroyed, and careful, time-consuming study of all exhibits and each page of the record has been required.

35 U.S.C. §112 provides:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention. A claim may be written in independent or dependent form, and if in dependent form, it shall be construed to include all the limitations of the claim incorporated by reference into the dependent claim.

Appellant cited 80 prior court opinions in its main brief. Appellee's brief totally ignores all but two of those citations, but adds 57 more. Appellant's reply brief cites 126 prior court opinions, 34 earlier cited, 67 newly cited, and 25 of those cited by appellee. Appellee's reply brief cites 17 prior court opinions, 4 earlier cited, 7 newly cited, and 6 of the 147 cited by appellant. Accordingly, 211 prior court opinions have been evaluated in relation to the proof found in the record.

In light of the entire record and the applicable law, we are convinced that Garlock failed to carry its burden of proving all claims of the present patents invalid.

Standard of Review

[1,2] Where, as here, dispositive legal error occurred in interpretation and application of the patent statute, 35 U.S.C., the parties' arguments relating to the salutary injunction of Fed. Rule Civ. P. 52(a) cannot be controlling on all issues. Though findings that "rest on an erroneous view of the law may be set aside on that basis," *Pullman-Standard v. Swint*, 456 U.S. 273 (1982), it is unnecessary here to set aside any probative fact found by the district court or to engage in what would be an inappropriate reweighing of the facts.

Among the legal errors extant in the record, each of which is discussed below, are (1) the invention set forth in each claim was not in each instance considered as a whole; (2) 35 U.S.C. §102(b) was applied though criteria for its application were not present; (3) the references were not assessed in their entireties; (4) an inherency theory under §§102 and 103 was inappropriately applied; (5) that which only the inventor taught was attributed to the prior art; (6) individual steps in prior art processes dealing with materials distinct from those with which the present inventions dealt were erroneously equated to steps in the claimed processes; (7) objective evidence of nonobviousness was disregarded; and (8) the function and application of §112 were misconstrued.

Because it permeated so much of the district court's analysis, we note more fully its frequent restriction of its consideration to 10% per second rate of stretching, which it called the "thrust of the invention." That approach is repeated throughout Garlock's briefs, which refer repeatedly to the "thrust of the invention," to "the inventive concept," and to the claims "shorn of their extraneous limitations." That facile focusing on the "thrust," "concept," and "shorn" claims, resulted in treating the claims at many points as though they read differently from those actually allowed and in suit.

[3] It is true that Dr. Gore emphasized rapid stretching, for example, as well as the amount of stretch and other process limitations, during prosecution of the application for the '566 patent. Yet it is the claims that measure and define the invention. *Aro Manufacturing Co. v. Convertible Top Replacement Co.*, 365 U.S. 336, 339, 128 USPQ 354 (1961); *Bowser, Inc. v. U.S.*, 388 F.2d 346, 349, 156 USPQ 406, 409 (Ct. Cl. 1967).

[4] Each claimed invention must be considered as a whole. 35 U.S.C. §103; *Schenck, A.G. v. Nortron Corp.*, 218 USPQ 698, 700 (Fed. Cir. 1983). In determining obviousness, there is "no legally recognizable or protected 'essential,' 'gist,' or 'heart' of the invention." *Aro*, 365 U.S. at 345. A court's restriction of a claimed multi-step process to one step constitutes error, whether done at the behest of a patentee relying on that restriction to establish infringement by one who employs only that one step in a process otherwise distinct, or at the behest of an accused infringer relying on that restriction to establish invalidity by showing that one step in a prior art process otherwise distinct.

(1) Invalidity

(a) '566 Patent

(i) §102(a) and The 401 Machine

It is undisputed that the district court held only claim 1 of the '566 patent to have been anticipated under §102(a) by operation of the 401 machine in the Gore shop before Dr. Gore's invention in late October 1969. It did so on the deposition testimony of two former Gore employees, documents, and drawings of the 401 machine.

In August 1969, Gore offered to sell to Export Tool Company (Export) tape "to be made" on the 401 machine. Tape made on the 401 machine was shipped to Export on October 24, 1969. The trial judge found the rolls on the 401 machine were, at least at some point in time before October 1969, spaced less than four feet apart and that the rate of stretch accomplished in operating that machine (admittedly operated in accord with the description of machine operation in the '915 patent) must have been greater than 10% per second. The district court credited testimony that Teflon 6-c, a highly crystalline form of Teflon, was used because it was the standard resin at the time, and that the tape was stretched at a temperature above 35°C. Thus it cannot be said that the record fails to support the district court's finding that the

limitations of claim 1 were met by Gore's operation of the 401 machine before Dr. Gore's asserted "late October 1969" date of invention. Though he was working with the operation of the 401 machine, Dr. Gore offered no proof that his invention date was before the date of shipment to Export.

[5] Gore, seeking a review here of the evidence, points to certain inadequacies as indicating a failure to meet the required clear and convincing standard under §102(a). At the time of trial, the district court, bound by precedent then applicable, applied a preponderance of the evidence test. Gore asserts, erroneously, that the clearly erroneous standard does not therefore apply on this appeal. Gore does not, however, point to any basis on which the district court's findings must be held to have been clearly erroneous under the clear and convincing standard. We are not at liberty, of course, to substitute our own for the district court's findings underlying its conclusion that claim 1 is invalid.

[6] Gore's operation of the 401 machine must thus be viewed as a consistent, reproducible use of Dr. Gore's invention as set forth in claim 1, and it is therefore irrelevant that those using the invention may not have appreciated the results. *General Electric Co. v. Jewel Incandescent Lamp Co.*, 326 U.S. 242, 248, 67 USPQ 155, 157-58 (1945). Were that alone enough to prevent anticipation, it would be possible to obtain a patent for an old and unchanged process. *Ansonia Brass & Copper Co. v. Electric Supply Co.*, 144 U.S. 11, 18 (1892); see, *H.K. Regar & Sons, Inc. v. Scott & Williams, Inc.*, 63 F.2d 229, 231, 17 USPQ 81, 83 (2d Cir. 1933).

[7] The nonsecret use of a claimed process in the usual course of producing articles for commercial purposes is a public use. *Electric Storage Battery Co. v. Shimadzu*, 307 U.S. 5, 20, 41 USPQ 155, 161 (1939), and there was no evidence that any different process was used to produce the articles shipped to Export.

Thus it cannot be said that the district court erred in determining that the invention set forth in claim 1 of '566 patent was known or used by others under §102(a), as evidenced by Gore's operation of the 401 machine before Dr. Gore's asserted date of that invention.

In view of our affirmation of the judgment reached on claim 1 under 102(a), we need not discuss other asserted grounds of invalidity of claim 1. There was, however, no evidence whatever that the inventions set forth in other claims, of either the '566 or the '390 patent, were known or used by others as a result of Gore's operation of the 401 machine before late October 1969.

(ii) §102(b) and the Cropper Machine

In 1966 John W. Cropper (Cropper) of New Zealand developed and constructed a machine for producing stretched and unstretched PTFE thread seal tape. In 1967, Cropper sent a letter to a company in Massachusetts, offering to sell his machine, describing its operation, and enclosing a photo. Nothing came of that letter. There is no evidence and no finding that the present inventions thereby became known or used in this country.

In 1968, Cropper sold his machine to Budd, which at some point thereafter used it to produce and sell PTFE thread seal tape. The sales agreement between Cropper and Budd provided:

ARTICLE "E" - PROTECTION OF TRADE SECRETS Etc.

1. BUDD agrees that while this agreement is in force it will not reproduce any copies of the said apparatus without the express written permission of Cropper nor will it divulge to any person or persons other than its own employees or employees of its affiliated corporations any of the said known-how or any details whatsoever relating to the apparatus.

2. BUDD agrees to take all proper steps to ensure that its employees observe the terms of Article "E" 1 and further agrees that whenever it is proper to do so it will take legal action in a Court of competent jurisdiction to enforce any one or more of the legal or equitable remedies available to a trade secret plaintiff.

Budd told its employees the Cropper machine was confidential and required them to sign confidentiality agreements. Budd otherwise treated the Cropper machine like its other manufacturing equipment.

A former Budd employee said Budd made no effort to keep the secret. That Budd did not keep the machine hidden from employees legally bound to keep their knowledge confidential does not evidence a failure to maintain the secret. Similarly, that du Pont employees were shown the machine to see if they could help increase its speed does not itself establish a breach of the secrecy agreement. There is no evidence of when that viewing occurred. There is no evidence that a viewer of the machine could thereby learn anything of which process, among all possible processes, the machine is being used to practice. As Cropper testified, looking at the machine in operation does not reveal whether it is stretching, and if so, at what speed. Nor does looking disclose whether the crystallinity and temperature elements of the invention set

forth in the claims are involved. There is no evidence that Budd's secret use of the Cropper machine made knowledge of the claimed process accessible to the public.

The district court held all claims of the '566 patent invalid under 102(b), supra, note 3, because "the invention" was "in public use [and] on sale" by Budd more than one year before Gore's application for patent. Beyond a failure to consider each of the claims independently, 35 U.S.C. §282; *Altoona Publix Theatres, Inc. v. American Tri-Ergon Corp.*, 294 U.S. 477, 487, 24 USPQ 308 (1935), and a failure of proof that the claimed inventions as a whole were practiced by Budd before the critical May 21, 1969 date, it was error to hold that Budd's activity with the Cropper machine, as above indicated, was a "public" use of the processes claimed in the '566 patent, that activity having been secret, not public.

Assuming, arguendo, that Budd sold tape produced on the Cropper machine before October 1969, and that that tape was made by a process set forth in a claim of the '566 patent, the issue under §102(b) is whether that sale would defeat Dr. Gore's right to a patent on the process inventions set forth in the claims.

[8] If Budd offered and sold anything, it was only tape, not whatever process was used in producing it. Neither party contends, and there was no evidence, that the public could learn the claimed process by examining the tape. If Budd and Cropper commercialized the tape, that could result in a forfeiture of a patent granted them for their process on an application filed by them more than a year later. *D.L. Auld Co. v. Chroma Graphics Corp.*, No. 83-585, slip op. at 5-6 (Fed. Cir. Aug. 15, 1983); See *Metalizing Engineering Co. v. Kenyon Bearing & Auto Parts Co.*, 153 F.2d 516, 68 USPQ 54 (2d Cir. 1946). There is no reason or statutory basis, however, on which Budd's and Cropper's secret commercialization of a process, if established, could be held a bar to the grant of a patent to Gore on that process.

[9,10] Early public disclosure is a linchpin of the patent system. As between a prior inventor who benefits from a process by selling its product but suppresses, conceals, or otherwise keeps the process from the public, and a later inventor who promptly files a patent application from which the public will gain a disclosure of the process, the law favors the latter. See *Horwath v. Lee*, 564 F.2d 948, 195 USPQ 701 (CCPA 1977). The district court therefore erred as a matter of law in applying the statute and in its determination that Budd's secret use of the Cropper machine and sale of tape rendered all process

claims of the '566 patent invalid under §102(b).

(iii) §103

In considering claims 1, 3, 17, and 19 of the '566 patent, the district court recognized that analysis of the obviousness issue under §103 requires determination of the scope and content of the prior art, the differences between the prior art and the claims at issue, and the level of ordinary skill in the pertinent art. *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966).

[11,12,13] In its consideration of the prior art, however, the district court erred in not taking into account the import of the markedly different behavior of PTFE from that of conventional thermoplastic polymers clearly established and undisputed on the record, and in thus disregarding the unpredictability and unique nature of the unsintered PTFE to which the claimed inventions relate. In *re* Whiton, 420 F.2d 1082, 164 USPQ 455 (CCPA 1970); in considering claims in less than their entireties, *Schenck, supra*; and in considering the references in less than their entireties, i.e., in disregarding disclosures in the references that diverge from and teach away from the invention at hand. In *re* Kuderma, 426 F.2d 385, 165 USPQ 575 (CCPA 1970).

Invalidity of claim 1 under §102(a) having been determined, it is unnecessary to discuss in detail the applicability of §103 to that claim. If claim 1 had not been held anticipated under §102(a) in light of operation of the 401 machine, it is clear, from the discussion here that claim 1 could not properly have been held invalid under §103.

Claim 3 depends from and thus incorporates claim 1 but specifies a rate of stretch of 100% per second. Claim 17 also depends from claim 1 and specifies an amount of stretch of about twice the original length. Claim 19 depends from claim 17 but specifies an amount of stretch of about five times the original length.

U.S. patent 2,983,961 to Titterton, Volume 13 of the *Encyclopedia of Polymer Science and Technology* (1970), the Sumitomo patent, and witnesses for both parties, establish that teachings related to conventional thermoplastic polymers are inapplicable to PTFE.

Articles by Dogliotti and Yelland, *Effect of Strain Rate on the Viscoelastic Properties of High Polymeric Fibrous Materials*, 4 *High Speed Testing* 211 (1964) and Robinson and Graham, *Methods of Characterization of Polymeric Materials by High Speed Testing Techniques*, 5 *High Speed Testing* 261

(1965), teach that conventional plastics and sintered PTFE can be stretched further if stretched slowly. Dr. Gore demonstrated at trial and at oral argument before us that an attempt to stretch highly crystalline, unsintered PTFE slowly results in breakage, and that rapid stretching produces a greatly lengthened rod of soft, flexible material.

The '566 patent contains an example of stretching an article to 16 times its length. Smith and the '915 patent teach that PTFE could not be stretched beyond four times its length without heating it to above its crystalline melt temperature, a step avoided by Dr. Gore and as set forth in the claims.

Sumitomo teaches that there is a length limit to stretching unsintered PTFE, and does not suggest what that limit might be. Markwood, U.S. patent 3,208,100 to Nash (Nash), and U.S. patent 2,823,421 to Scarlett (Scarlett) teach that *non-PTFE* thermoplastics can be stretched rapidly and to extended lengths, and also teach reduction, elimination, or avoidance of crystallinity before stretching.

The disclosure in the Smith and '915 patents that a PTFE article may be stretched to as much as four times its length encompasses the step of stretching to twice its length set forth in claim 17 and establishes that such step would have been obvious.

[14] Claims 3 and 19 must be considered individually and separately. 35 U.S.C. §282. Nowhere, in any of the references, is it taught or suggested that highly crystalline, unsintered PTFE could be stretched at a rate of about 100% per second as required by asserted claim 3. Nor is it anywhere suggested that by rapid stretching a PTFE article be stretched to more than five times its original length as required by asserted claim 19. On the contrary, the art as a whole teaches the other way.

[15] In concluding that obviousness was established by the teachings in various pairs of references, the district court lost sight of the principle that there must have been something present in those teachings to suggest to one skilled in the art that the claimed invention before the court would have been obvious. In *re* Bergel, 292 F.2d 955, 956-57, 130 USPQ 206, 208 (CCPA 1961); In *re* Sponnoble, 405 F.2d 578, 585, 160 USPQ 237, 244 (CCPA 1969).

The court's pairing of Sumitomo and Markwood disregarded, as above indicated, the undisputed evidence that the unsintered PTFE of Sumitomo does not respond to the conventional plastics processing of Markwood and the art recognition of that fact. Whiton, *supra*, 420 F.2d at 1085, 164 USPQ at 457.

In evaluating claim 19, for example, the pairing disregarded Sumitomo's limited

length of stretch teaching. In evaluating claim 3, the court recognized that Sumitomo made no mention of rate of stretch. Looking to Markwood to supply that teaching disregarded not only the conventional plastics-unsintered PTFE distinction but also the clear divergence of Markwood's teaching that crystallinity must be reduced or avoided from the presence of "highly crystalline" in all claims of the '566 patent.

Similarly, and for many of the same reasons, the pairing of Markwood's and Smith's teachings was an inappropriate basis for concluding that the processes set forth in claims 3 and 19 would have been obvious. As above indicated, Markwood's rapid stretching of conventional plastic polypropylene with reduced crystallinity would not suggest rapid stretching of highly crystalline PTFE, in light of teachings in the art that PTFE should be stretched slowly. The Smith patent is owned by du Pont, where Dr. Gore's process invention was considered to have produced a "remarkable new material." That circumstance is not surprising, for Smith, though dealing with PTFE, says not a word about any rate of stretch.

Lastly, the pairing of Sumitomo and the '915 patent suffers from the same shortcomings. The pairing resulted from a hypothetical set forth in Garlock's post trial brief, and was based on no testimony or other evidence in the record. In respect to claim 3, neither reference mentions rate of stretch or suggests its importance. In respect of claim 19 both references point away from the claimed invention in their limited length-of-stretch teachings. The '915 patent states: "the 65 percent expanded material could be expanded a second time for an additional 65 percent expansion or a total length increase ratio of 1:2.72 [less than three times the original length]. However, great care was necessary to obtain a uniformly expanded material at these very great expansion ratios." Thus the '915 patent suggests that the amount of stretch of 500% set forth in claim 19 (more than five times the original length) is not possible.

As indicated, Sumitomo and Smith are totally silent respecting the rate of stretch, and there is simply no teaching in the art that would suggest to one of ordinary skill that Markwood's fast stretching of other thermoplastics could or should be employed in the process of treating PTFE taught by either Sumitomo or Smith. Indeed, Smith not only says nothing about rate of stretch, its preferred teaching is away from other elements of the inventions set forth in claims 3 and 19. Smith discloses that stretching should be done after the PTFE is heated above its crystalline

melting point and with decreased crystallinity. Smith teaches:

Below about 300°C it is *not possible* to draw more than about 4X [times] and while such draw ratios can be attained around 300°C and below the polymer's crystalline melting point with resultant orientation and improved properties it is preferred to use temperatures at or above the polymer's crystalline melting point. (Emphasis added).

Nash teaches that the film should be plasticized, i.e., made more viscous, before stretching. Contrary to that teaching, Dr. Gore did not reduce crystallinity before increasing the rate of stretch, but maintained the unsintered PTFE "highly crystalline" while stretching at a 100% per second rate and to more than five times, as set forth respectively in claims 3 and 19.

[16] On the entire record and in view of all the references, each in its entirety, it is clear that a person of ordinary skill confronted with a PTFE tape breakage problem would have either slowed the rate of stretching or increased the temperature to decrease the crystallinity. Dr. Gore did neither. He proceeded contrary to the accepted wisdom of the prior art by dramatically increasing the rate and length of stretch and retaining crystallinity. That fact is strong evidence of nonobviousness. *United States v. Adams*, 383 U.S. 39 (1966).

Having learned the details of Dr. Gore's invention, the district court found it within the skill of the art to stretch other material rapidly (Markwood); to stretch PTFE to increase porosity (Sumitomo); and to stretch at high temperatures (Smith). The result is that the claims were used as a frame, and individual, naked parts of separate prior art references were employed as a mosaic to recreate a facsimile of the claimed invention. At no point did the district court, nor does Garlock, explain why that mosaic would have been obvious to one skilled in the art in 1969, or what there was in the prior art that would have caused those skilled in the art to disregard the teachings there found against making just such a mosaic. On the contrary, the references and the uncontested testimony, as above indicated, established that PTFE is *sui generis*. It is not surprising, therefore, that, unlike the situation in *Stratoflex, Inc. v. Aeroquip Corp.*, 218 USPQ 871 (Fed. Cir. 1983), there was no testimony and no finding that one skilled in the art would transfer conventional thermoplastic processes to those for unsintered PTFE, or would have been able to predict what would happen if they did.

[17] To imbue one of ordinary skill in the art with knowledge of the invention in suit,

when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.

[18] It is difficult but necessary that the decisionmaker forget what he or she has been taught at trial about the claimed invention and cast the mind back to the time the invention was made (often as here many years), to occupy the mind of one skilled in the art who is presented only with the references, and who is normally guided by the then-accepted wisdom in the art. Had that been here done the inventions set forth in the claims 3 and 19 of the '566 patent could only have been held non-obvious to those skilled in the art at the time those claimed inventions were made.

[19] Error in visualizing the burden of proof on obviousness may have contributed to the court's application here of the prior art. Adopting the phrase from earlier precedents, the court said "the presumption [of validity] is weakened greatly where the Patent Office has failed to consider pertinent prior art." That is not the law of established precedent in this court. *SSIH Equipment S.A. v. ITC*, 218 USPQ 678, 687 (Fed. Cir. 1983); *Solder Removal Co. v. ITC*, 582 F.2d 628, 633, 199 USPQ 129, 133, n. 9 (CCPA 1978). The presumption has no separate evidentiary value. It cautions the decisionmaker against a rush to conclude invalidity. Submission of additional art that is merely "pertinent" does not dispel that caution. It is difficult to imagine a patent law suit in which an accused infringer is unable to add some new "pertinent" art. The inescapable burden of persuasion on one who would prove invalidity, however, remains throughout the trial. 35 U.S.C. §282.

[20] The burden of proving invalidity may of course be facilitated by prior art that is *more pertinent* than that considered by the PTO. That did not happen here. In the present case, Sumitomo, Smith, and the '915 patent were among references considered by the PTO. Other references referred to as not considered were merely cumulative, disclosing nothing not disclosed in references that were considered by the PTO. The Canadian counterpart of Nash was considered by the PTO. The relevant disclosures of Markwood appear in Sandiford patent 3,544,671 and Paratheaon patent 3,637,906, both considered by the PTO. The Russian Author's Certificate 240,997, assuming its status as prior art and whatever the material with which it dealt, contributed nothing beyond the teachings of the '915 patent considered by the PTO.

[21] As discussed more fully below, the district court erred in specifically declining to

consider the objective evidence of nonobviousness. In *re Sernaker*, 702 F.2d 989, 996, 217 USPQ 1, 7 (Fed. Cir. 1983). That evidence can often serve as insurance against the insidious attraction of the siren hindsight when confronted with a difficult task of evaluating the prior art. Though the prior art evidence here pointed more in the direction of nonobviousness than obviousness, the objective evidence may tend, as it did in *Sernaker*, supra, to reassure the decisionmaker.

In sum, the district court erred as a matter of law on this record in concluding that Garlock had met its burden of proving that the inventions of claims 3 and 19 of the '566 patent would have been obvious.

(b) '390 patent

(i) §102

The district court found product claims 1, 9, 12, 14, 18 and 43 inherently anticipated because it found that the microstructure of nodes interconnected by fibrils is an inherent characteristic of paste-extruded PTFE products resulting from the process disclosed in Smith. The court found the first four of those claims and claim 43, plus claims 35, 36, 67 and 77 inherently anticipated because high strength PTFE products are inherent in the examples of Sumitomo.

The teachings of Smith include neither a disclosure nor a suggestion of "porous" products having a "microstructure characterized by nodes interconnected by fibrils" as required by the claims found to have been anticipated by Smith.

The teachings of Sumitomo do not include a disclosure of products having "a matrix tensile strength * * * above about 7,300 psi" as required by the claims found to have been anticipated by Sumitomo.

[22] Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration. *Soundsciber Corp. v. U.S.*, 360 F.2d 954, 960, 148 USPQ 298, 301, adopted, 149 USPQ 640 (Ct. Cl. 1966). Neither Smith nor Sumitomo disclose an invention set forth in any claim of the '390 patent.

The incongruity in findings that the different processes of Smith and Sumitomo each inherently produced identical products is striking.

Garlock attempted with expert testimony to overcome the prior art shortcomings as proof of anticipation. Gore rebutted with its own expert testimony. It is unnecessary, however, to resolve apparent conflicts in the divergent testimony, much if not all of which took

the form of pure unsupported assertion. No inter partes tests in which the Smith and Sumitomo processes were conducted are of record. No products of those processes were placed in evidence, and there was, of course, no analysis of any such evidentiary products.

Nor is it necessary to evaluate the inappropriate disparagement in Garlock's brief of Dr. Sperati as a "friend" of Gore.

[23] Given the unique nature of unsintered PTFE, we are not persuaded that the "effect" of the processes disclosed in Smith and Sumitomo, an "effect" undisclosed in those patents, would be always to inherently produce or be seen always to produce products meeting all of the claim limitations. Anticipation of inventions set forth in product claims cannot be predicated on mere conjecture respecting the characteristics of products that might result from the practice of processes disclosed in references. In re Felton, 484 F.2d 495, 500, 179 USPQ 295, 298 (CCPA 1973). It is clear that the teachings of neither Smith nor Sumitomo place the products claimed in the '390 patent in possession of the public.

The teachings of Smith and Sumitomo are so unacceptably vague concerning characteristics of products produced by their respective processes as not to support an anticipation rejection. That fact is confirmed by the PTO's having fully considered those references and by its having issued the '390 patent over them.

[24] Garlock's assertion that it employs a process covered by the Smith patent, if true, is irrelevant. The '390 patent was allowed over Smith as a reference. Assuming Smith is a dominating patent, the rule of law is clear that an accused infringer's employment of the process of a dominating patent does not render that employment an anticipation of an invention described and claimed in an improvement patent. As indicated, there is no present record basis for finding that the Smith process in itself necessarily and inherently results in the products, each considered in its entirety, in the claims of the '390 patent. The testimony of Garlock's expert about ex parte tests, the records of which he destroyed before trial, cannot serve as such a basis. The effusive praise of Dr. Gore's claimed products by the owner of the Smith patented process would appear, on the contrary, to confirm the action of the PTO in issuing the '390 patent.

Garlock has not met its burden of showing that claims 1, 9, 12, 14, 18, and 43 are anticipated by Smith or that claims 1, 9, 12, 14, 35, 36, 43, 67, and 77 are anticipated by Sumitomo.

(ii) §103.

[25] The scope and content of the prior art and level of ordinary skill, discussed above in relation to the '566 patent, would be the same for the '390 patent. The district court did not, however, nor does Garlock, apply the Graham criteria, supra, to the '390 claims, apparently assuming that the claimed products, having been found inherent in the processes of Sumitomo and Smith, would have been obvious in view of those references. If so, that was error. Inherency and obviousness are distinct concepts. In re Spormann, 363 F.2d 444, 448, 150 USPQ 449, 452 (CCPA 1966).

In discussing inherency the district court did recognize differences between Smith's disclosure and the inventions set forth in claims 1, 9, 12, 14, 18, and 43, i.e., the absence from Smith of a description of the products of Smith's process as porous and the absence from Smith of a disclosure that those products have a microstructure characterized by nodes interconnected by fibrils.

Similarly, a difference between Sumitomo's disclosure and the inventions set forth in claims 1, 9, 12, 14, 35, 36, 43, 67, and 77 was recognized in the absence from Sumitomo of a quantification of the matrix tensile strengths of the products of Sumitomo's process. The district court also discussed differences between the dependent claims and the prior art. Because we conclude that the independent claims of the '390 patent are patentable over the art of record, we need not discuss the dependent claims.

[26] Having determined that the invention would have been obvious in view of the process of either Smith or Sumitomo, the district court did not discuss the strong showing of objective evidence of nonobviousness here present, saying with respect to one part of such evidence, "no amount of commercial success can save it." That approach was error. All evidence bearing on the issue of obviousness, as with any other issue raised in the conduct of the judicial process, must be considered and evaluated *before* the required legal conclusion is reached. Stratoflex, supra, 218 USPQ at 879.

[27] The objective evidence of nonobviousness, i.e., the "indicia" of Graham, supra, may in a given case be entitled to more weight or less, depending on its nature and its relationship to the merits of the invention. It may be the most pertinent, probative, and revealing evidence available to aid in reaching a conclusion on the obvious/nonobvious issue. It should when present always be considered as an integral part of the analysis.

Gore's fabric laminates, for example, as set forth in claims 36 and 77, satisfied a long-felt

need for a material having the contradictory properties of being simultaneously breathable (allowing water vapor or perspiration to pass) and waterproof. The record establishes that such a material had long been sought by makers of rainwear and outerwear, and by the U.S. Army as well. That Gore's fabric laminates filled that need is attested by the rise in their annual dollar sales from zero to seven million in the first five years of their availability.

Gore's PTFE tubes for replacement of human arteries and veins, also satisfied a long-felt need. The uncontradicted evidence establishes that Gore's PTFE tubes hold blood without leaking, need not be pre-clotted with the patient's blood, are chemically inert, and, being breathable, are less likely to cause an air embolism. The value and uniqueness of those four properties make Gore's PTFE tubes, as described in unchallenged testimony, "the most important synthetic material presently existing" in vascular surgery, and, along with other evidence in the record, reflect the intended working of the patent system.

As discussed above, current annual sales of over sixty million dollars are attributable to the merits of the products claimed in the '390 patent. Considering the long-felt need for those products and the obvious commercial advantage to be gained by meeting that need, it is reasonable to conclude that the claimed products of the '390 patent would not have been obvious to persons of ordinary skill in the art at the time the claimed inventions were made.

[28] As above indicated, the praise which greeted the products claimed in the '390 patent from PTFE suppliers, including the owner of the Smith patent, is further objective evidence of nonobviousness.

[29] Garlock's appeal argument that the '390 claims are invalid because the recited minimum matrix tensile strengths are not "critical" is without merit. A claim to a new product is not legally required to include critical limitations. In re Miller, 441 F.2d 689, 696, 169 USPQ 597, 602 (CCPA 1971). The '390 claims are not drawn to optimization of ingredients or ranges within broad prior art teachings, but to new porous PTFE products of particular characteristics.

In sum, and in view of the difficulty of working with unsintered PTFE and its unpredictable response to various processing techniques, the vagueness of Smith and Sumitomo concerning the products produced by those processes, the filling of at least two long-felt needs and the commercial success described above, we conclude that the inventions set forth in claims 1, 9, 12, 14, 18, 35, 36, 43, 67, and 77 of the '390 patent would

not have been obvious to those skilled in the art at the time those inventions were made.

(c) §112 and the '566 and '390 patents

The patents in suit resulted from a single application and thus have substantially identical specifications. The holding of invalidity on the basis of §112 is common to both patents.

The district court found that the patents did not disclose sufficient information to enable a person of ordinary skill in the art to make and use the invention, as required by §112, first paragraph, and that certain claim language was indefinite, presumably in light of §112, second paragraph, because: (1) there was no definition in the specification of "stretch rate," different formulae for computing stretch rate having been developed and presented at trial; (2) there was no way taught in the specification to calculate the minimum rate of stretch above 35°C; (3) the phrase "matrix tensile strength" is indefinite; and (4) the phrase "specific gravity of the solid polymer" is indefinite.

[30] The findings rest on a misinterpretation of §112; its function and purpose. The district court considered whether certain terms would have been enabling to the public and looked to formula developments and publications occurring well after Dr. Gore's filing date in reaching its conclusions under §112. Patents, however, are written to enable those skilled in the art to practice the invention, not the public. In re Storrs, 245 F.2d 474, 478, 114 USPQ 293, 296-97 (CCPA 1957), and §112 speaks as of the application filing date, not as of the time of trial. In re Mott, 539 F.2d 1291, 1296, 190 USPQ 536, 541 (CCPA 1976). There was no evidence and no finding that those skilled in the art would have found the specification non-enabling or the claim language indefinite on May 21, 1970, when the application which resulted in issuance of Dr. Gore's patents was filed. Indeed, the expert quoted by the district court and whose testimony was primarily relied upon respecting formulae, was still in school at that time.

There is uncontradicted evidence in the record that at the time the application was filed "stretch rate" meant to those skilled in the art the percent of stretch divided by the time of stretching, and that the latter was measurable, for example, with a stopwatch. Concern for the absence from the specification of a formula for calculating stretch rate is therefore misplaced, and the post-filing date development of varying formulae, including Dr. Gore's later addition of a formula in his corresponding Japanese patent, is irrelevant.

[31] Section 112 requires that the inventor set forth the best mode of practicing the invention known to him at the time the application was filed. Calculating stretch rate at that time was accomplished by actually measuring the time required to stretch the PTFE material. That was the only mode then used by the inventor, and it worked. The record establishes that calculation by that mode would have been employed by those of ordinary skill in the art at the time the application was filed. As indicated, Dr. Gore's disclosure must be examined for §112 compliance in light of knowledge extant in the art on his application filing date.

[32] The district court, though discussing enablement, spoke also of indefiniteness of "stretch rate," a matter having to do with §112, second paragraph, and relevant in assessment of infringement. The use of "stretching *** at a rate exceeding about 10% per second" in the claims is not indefinite. Infringement is clearly assessable through use of a stopwatch. No witness said that could not be done. As above indicated, subsequently developed and therefore irrelevant formulae cannot be used to render non-enabling or indefinite that which was enabling and definite at the time the application was filed.

[33] Similarly, absence from the specification of a method for calculating the minimum rate of stretch above 35°C does not render the specification non-enabling. The specification discloses that "[t]he lower limit of expansion rates interact with temperature in a roughly logarithmic fashion, being much higher at higher temperatures." Calculation of minimum stretch rate above 35°C is nowhere in the claims, and it is the *claimed* invention for which enablement is required. The claims require stretching at a rate greater than 10% per second at temperatures between 35°C and the crystalline melt point of unsintered PTFE. That the minimum rate of stretch may increase with temperature does not render non-enabling Dr. Gore's specification, particularly in the absence of convincing evidence that those skilled in the art would have found it non-enabling at the time the application was filed.

[34] The district court invalidated both patents for indefiniteness because of its view that some "trial and error" would be needed to determine the "lower limits" of stretch rate above 10% per second at various temperatures above 35°C. That was error. Assuming some experimentation were needed, a patent is not invalid because of a need for experimentation. *Minerals Separation, Ltd. v. Hyde*, 242 U.S. 261, 270-71 (1916). A patent is invalid only when those skilled in the art are required to

engage in *undue* experimentation to practice the invention. In *re Angstadt*, 537 F.2d 498, 503-04, 190 USPQ 214, 218 (CCPA 1976). There was no evidence and the court made no finding that undue experimentation was required.

[35] Moreover, the finding here rested on confusion of the role of the specification with that of the claims. The court found that the specification's failure to state the lower limit of stretch rate (albeit above 10% per second) at each degree of temperature above 35°C (a requirement for at least hundreds of entries in the specification) did not "distinguish processes performed above the 'lower limit' from those performed below the 'lower limit'." The claims of the '390 patent say nothing of processes and lower limits. Distinguishing what infringes from what doesn't is the role of the claims, not of the specification. It is clear that the specification is enabling. In *re Storrs*, *supra*, and that the claims of both patents are precise within the requirements of the law. In *re Moore*, 439 F.2d 1232, 169 USPQ 236 (CCPA 1971).

[36] The finding that "matrix tensile strength" is indefinite, like the other findings under §112, appears to rest on a confusion concerning the roles of the claims and the specification. While finding "matrix tensile strength" in the claims indefinite, the district court at the same time recognized that the specification itself disclosed how to compute matrix tensile strength, in stating "to compute matrix tensile strength of a porous specimen, one divides the maximum force required to break the sample by the cross sectional area of the porous sample, and then multiplies this quantity by the ratio of the specific gravity of the solid polymer divided by the specific gravity of the porous specimen." Further, the specification provided the actual matrix tensile strength in several examples. It is well settled that a patent applicant may be his own lexicographer. In light of the disclosure of its calculation in the specification, we cannot agree that "matrix tensile strength" is either indefinite or non-enabling.

Nor does absence from the specification of a definition for "specific gravity of the solid polymer," a part of the computation of matrix tensile strength, render that computation indefinite. It is undisputed that in the many examples in the application the specific gravity values used for unsintered and sintered PTFE were 2.3 and 2.2, respectively. There was no testimony that those values were not known to persons of ordinary skill in the art or could not be calculated or measured. There is simply no support for the conclusion that "specific gravity of the solid polymer" is indefinite or that absence of its definition ren-

ders the specification non-enabling. See *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

We conclude that Garlock has failed to prove that at the time the application was filed, the specification was not enabling or that the claims were indefinite within the meaning of §112.

(2) Fraud

[37] Fraud must be shown by clear and convincing evidence. *Norton v. Curtiss*, 433 F.2d 779, 167 USPQ 532, 546-47 (CCPA 1970).

The state of mind of the one making the representations is probably the most important of the elements to be considered in determining the existence of "fraud." * * * Good faith and subjective intent, while they are to be considered, should not necessarily be made controlling. Under ordinary circumstances, the fact of misrepresentation coupled with proof that the party making it had knowledge of its falsity is enough to warrant drawing the inference that there was a fraudulent intent. Where public policy demands a complete and accurate disclosure it may suffice to show nothing more than that the misrepresentations were made in an atmosphere of gross negligence as to their truth. [emphasis in original].

Norton, 433 F.2d at 795-96; 167 USPQ at 545; see, *Miller*, *Fraud on the PTO*, 58 JPOS 271 (1976).

Garlock alleges fraud in Gore's representations that stretching PTEE tape at a rate greater than 10% per second was novel and that it produces a physical phenomenon. The district court found the evidence insufficient to establish that Gore had a specific intent to defraud the PTO. No basis exists for our overturning that finding. Accordingly, we agree with the district court that Garlock has failed to sustain its heavy burden of proving, by clear and convincing evidence, sufficient facts from which fraudulent intent can be inferred.

Garlock points to a September 4, 1975, Gore affidavit filed in the PTO that stated:

2. Prior to my invention disclosed in the captioned patent application, during production of expanded PTFE products by W. L. Gore & Associates, Inc., the rate of stretching was neither measured nor controlled and to my knowledge did not involve stretching of unsintered PTFE at a rate exceeding about 10% per second. (emphasis in original)

No finding of the district court and no evidence of record establishes that that state-

ment was made in reckless disregard of facts from which an intent to defraud may be inferred.

The district court's finding in 1982 that the 401 machine inherently stretched tape at some time in 1969 at a rate more than 10% per second, does not establish that Dr. Gore was aware of that fact in 1975, nor does it make untrue his statement that to his knowledge that had not been the rate of stretch employed. Nor does the district court's finding conflict with Dr. Gore's statement that the rate of stretching was neither measured nor controlled in the Gore shop before his invention of the claimed process as a whole.

Nor does the evidence of isolated statements support Garlock's contention that Dr. Gore attempted to convince the PTO that a physical phenomenon always existed in which stretching at a rate greater than 10% per second always produced a matrix tensile strength greater than 7300 psi. On the contrary, Dr. Gore set forth in his specification examples indicating that some samples broke, ruptured, or disintegrated.

(3) Attorney's Fees

The district court did not abuse its discretion in denying Garlock its request for attorney fees.

Infringement

[38] Where, as here, an appellate court reverses a holding of invalidity, and remand is ordered for trial of the factual issue of infringement, an inefficient use of judicial resources results if the second judgment is appealed. The better practice would therefore be for the district court to decide both the validity and infringement issues when both are contested at the trial, enabling the conduct of a single appeal and disposition of the entire case in a single appellate opinion.

Resolution of the infringement issue at trial may also overlap with resolution of the validity issue, where, for example, the claimed invention was or was not copied by the validity challenger, or the challenger substituted the claimed invention for freely available prior art processes or products, *Eibel*, supra, 261 U.S. at 56, or an assertion of nonenablement may conflict with the ease with which the accused infringer may be shown to have practiced the invention as taught in the patent. *Eibel Process Co. v. Minnesota & Ontario Paper Co.*, 261 U.S. 45, 61 (1923).

[39] The district court having declined to decide the infringement issue, Gore suggests that the record here is sufficient to warrant

our deciding it now. With reluctance in view of the length and bitter nature of the present litigation, we decline the suggestion. In so doing, we imply nothing of our view on the issue. Nor do we intend any implication that the district court could not itself determine the infringement issue on the present record. Infringement of particular claims of two patents was asserted. None of those claims has been finally held invalid. Assuming their continued assertion, infringement must be decided with respect to each asserted claim as a separate entity. *Altoona, supra*, 294 U.S. at 487. Those factual determinations should be made in the first instance by the district court.

Decision

The holdings of invalidity of claim 1 of the '566 patent under §102(a) and of claim 17 of the '566 patent under §103, the determination that Gore did not commit fraud on the PTO, and the denial of attorney fees, are affirmed; the holdings that all claims of the '566 patent are invalid under §102(b), that claims 3 and 19 of the '566 patent are invalid under §103, and that all claims of the '566 patent are invalid under §112, are reversed. The holdings that claims 1, 9, 12, 14, 18, 35, 36, 43, 67, and 77 of the '390 patent are invalid under §§102 and 103, and that all claims of the '390 patent are invalid under §112, are reversed. The case is remanded for determination of the infringement issue.

Affirmed in part, reversed in part, and remanded.

Appendix

Claims of the '566 patent discussed at trial:

1. A process for the production of a porous article of manufacture of a polymer of tetrafluoroethylene which process comprises expanding a shaped article consisting essentially of highly crystalline poly (tetrafluoroethylene) made by a paste-forming extrusion technique, after removal of lubricant, by stretching said unsintered shaped article at a rate exceeding about 10% per second and maintaining said shaped article at a temperature between about 35°C. and the crystalline melt point of said tetrafluoroethylene polymer during said stretching.

3. The process of claim 1 in which the rate of stretch is about 100% per second.

17. The process of claim 1 in which the shaped article is expanded such that its final length in the direction of expansion is greater than about twice the original length.

19. The process of claim 17 in which said final length is greater than about five times the original length.

Claims of the '390 patent discussed at trial:

1. A porous material consisting essentially of highly crystalline polytetrafluoroethylene polymer, which material has a microstructure characterized by nodes interconnected by fibrils and has a matrix tensile strength in at least one direction above about 73,000 psi.

9. A porous material consisting essentially of polytetrafluoroethylene polymer, which material has a microstructure characterized by nodes interconnected by fibrils and has a matrix tensile strength in at least one direction above 9290 psi, which material has been heated to a temperature above the crystalline melt point of said polymer and has a crystallinity below about 95%.

12. A porous material in accordance with claim 9 which is in the form of a shaped article.

14. A product in accordance with claim 12 which is in the form of a film.

18. A product in accordance with claim 12 which is in the form of continuous filaments.

35. A laminated structure comprising (a) a first shaped article formed of a porous material made of a tetrafluoroethylene polymer, which material has a microstructure characterized by nodes interconnected by fibrils and has a matrix tensile strength in at least one direction above about 7,300 psi, and (b) a second shaped article bonded to said first shaped article.

36. The structure of claim 35 in which said first shaped article is formed of a porous material which has a matrix tensile strength in at least one direction of at least 9290 psi, and has a crystallinity below about 95%.

43. A porous material made of a tetrafluoroethylene polymer, which material has a microstructure characterized by nodes interconnected by fibrils, which material (a) has a matrix tensile strength in at least one direction above about 9290 psi, (b) has been heated to a temperature above 327°C. and has a crystallinity below about 95%, and (c) has a dielectric constant of 1.2-1.8.

67. An impregnated structure comprising

(a) a shaped article formed of a porous material made of a tetrafluoroethylene polymer which material has a microstructure characterized by nodes interconnected by fibrils and a matrix tensile strength in at least one direction above about 9290 psi, and

(b) a polymer impregnated within the pores of the said shaped article.

77. The structure of claim 35 in which the first shaped article is a sheet having pores that will pass a gas but will not pass liquid water.

Davis, Circuit Judge, concurring in the result in part and dissenting in part.

I concur in the result on (1) the validity of the '390 patent under §§ 102-103; (2) the validity of the '390 patent under §112; (3) the invalidity of claims 1 and 17 of the '566 patent; (4) lack of fraud on the Patent and Trademark Office; and (5) denial of attorneys' fees. I disagree and dissent as to the validity of claims 3 and 19 of the '566 patent.

1. The process invention embodied in claim 1 of the '566 patent was known, through use of the 401 machine in the Gore shop, well before the "invention date" (claimed by Robert Gore, the inventor) of October 1969.¹ As such, the claimed invention was invalid on at least three grounds: (i) it was anticipated and therefore would have been obvious (under 35 U.S.C. §103) at the time of the claimed invention date; (ii) the invention was "in public use" by the Gore shop (under 35 U.S.C. §102(b)) more than one year prior to the patent application (i.e., prior to May 21, 1969); and (iii) the invention (made by Robert Gore) was known to and used "by others in this country" (35 U.S.C. §102(a)) before the claimed invention date of October 1969, i.e. the invention was used by Wilbert Gore and others in the Gore shop before the October date.²

The critically important aspect of the invention of the '566 patent is the stretching of PTFE at a rate above 10% per second.³ Robert Gore testified that he conceived this invention no earlier than October 1969 (and we have the right to take him at his word),⁴ but the facts found by the District Court plainly show that the Gore shop was in fact practicing that invention considerably earlier.

The District Court found that in the 401 machine the distance between the stretch rollers controls the rate of stretch; a shorter distance results in a higher rate of stretch; for the process described in the '915 patent to be practiced with a rate of stretch below 10% per second, the distance between the stretch rollers would have to be greater than five feet; if the distance is less than four feet, the rate of stretch is greater than 10% per second; the machine drawings used to construct the 401 machine indicate that the distance between the stretch rollers was eight inches; a Gore employee testified that "I am reasonably sure that no effective [stretch] rolls in question would have been more than three feet simply because of the nature and size of the equipment" and that he did not remember any stretching more than three feet; another Gore employee testified that the distance between the rollers was "a maximum of 18 inches" (emphasis added); a document prepared by the same employee (an engineer) on June 10, 1969 reports that the stretch span was 8 inches; the 401 machine was the only stretching machine used by the Gore company; and the 401 machine was never substantially changed before October 1969. All this adds up to the fact that the 401 machine was at all relevant times operated with a stretch of less than four feet.⁵ There is no question that the machine was so operated before October 1969 (the District Court found that sales of tape made by the 401 machine were proposed in August 1969).

I can accept Robert Gore's affidavit (to the PTO) that there was no stretching in the Gore shop at a rate exceeding about 10% per second prior to "my invention disclosed in the captioned patent application" (emphasis added),⁶ only because that declaration was expressly qualified by the phrase "to my knowledge" (emphasis added). The District Court specifically found no specific intent by Robert Gore to defraud and, on this record, we

¹ The Gores (Robert and Wilbert) testified at trial that the distance was five feet but there is no indication that the trial court (which did not cite this testimony but did cite the opposing evidence) credited the Gores' testimony.

² The factor of the rate of stretching was of direct interest to the examiner during the prosecution of the '566 patent. In response to the examiner's express request for a declaration that the Gore firm's production of stretched PTFE tape, prior to Robert Gore's invention asserted here, did not involve stretching of unsintered PTFE at a rate exceeding about 10% per second, Robert Gore filed an affidavit in the PTO specifically stating that "to my knowledge" (emphasis added) the 401 machine did not involve stretching at a rate exceeding about 10% per second.

³ The 401 machine was used under the prior '915 patent (issued to Wilbert Gore) which contains no reference to the significance of the rate of stretch.

⁴ Aside from the bases I discuss, I do not reach the other grounds asserted for invalidity of the '566 patent.

⁵ Before the PTO Robert Gore concededly referred to this as "critical" to his invention or as his "invention."

⁶ The District Court found that October 1969 was the earliest date Robert Gore asserts for his conception of the invention in the '566 patent.

cannot properly overturn that finding. But the absence of personal intent to defraud does not mean or say that, whether Robert Gore realized it or not, the 401 machine was not actually operating, well before October 1969, to stretch unsintered PTFE at a rate exceeding about 10% per second. Cf. *O'Brien v. Westinghouse Electric Corp.*, 293 F.2d 1, 10 (3rd Cir. 1961). It seems impossible to me to reconcile Robert Gore's insistence on two facts--that (i) he invented the process in October 1969 and (ii) he had no knowledge prior to October 1969 of stretching PTFE at the critical rate--with the solid facts in the record as to the prior operation of the 401 machine, except on the view that Robert Gore did not realize that he and others in the Gore shop had made his invention previously.

2. It follows that in October 1969 the invention of '566 would have been obvious under §103 to Robert Gore because the prior practice of the 401 machine constituted prior art. Even if this was not prior art technically within §102, that statutory provision "is not the only source of prior art." *In re Fout*, 675 F.2d 297, 300 (CCPA 1982, emphasis in original). The 401 machine was practiced under the '915 patent (issued to Wilbert Gore) and, whether or not Robert Gore subjectively realized what was happening, he and others in the Gore shop were practicing the invention later embodied in the '566 patent. That was prior art at least as to Robert Gore. *Id.* at 300-01.⁷

3. If it be thought necessary to invoke §102 directly, in order to show anticipation, the record contains proof that the 401 machine was designed, constructed and used (just as described supra) in November and December 1968 and the early months of 1969--more than one year prior to the '566 patent application of May 21, 1970. See *Jt. App. E 1199-E 1200*. Section 102(b) therefore applies. Although commercial production was apparently not actively sought until June 1969, the practicing of the 401 machine prior to May 21, 1969 was "a public use" because the Gore company made "use of the device *** in the factory in the regular course of business." *Connecticut Valley Enterprises, Inc. v. United States*, 348 F.2d 949, 952, 146 USPQ 404, 406 (Ct. Cl. 1965).

⁷ The District Court has found that there are no differences between claim 1 of the '566 patent and the processes previously used by the Gore firm to produce paste-extruded unsintered PTFE.

4. Also, §102(a)⁸ applies here because Robert Gore was the inventor in the '566 patent and Wilbert Gore and others in the Gore shop were using the 401 machine before October 1969. Wilbert Gore (the inventor in the '915 patent under which the 401 machine was made and used) and the other employees are "others" within §102(a)--they are not the same as Robert Gore who claimed to be inventor of the process that ripened into the '566 patent.⁹ See also §102(f), which would bar Robert Gore if he did not himself invent the subject matter of the '566 patent.¹⁰

5. The majority sustains the validity of claims 3 and 19 of the '566 patent (the claims also involved in appellant's suit for infringement) which are dependent on invalid claim 1. Because of the invalidity of claim 1 the only possible novelty in claim 3 would be the requirement that the rate of stretch would be about 100% per second, and the possible novelty of claim 19 would be that the final length would be greater than about five times the original length. My position is that both of these added elements, if novel, would have been obvious to persons of ordinary skill in the art.

The defect in the majority's analysis is that it neglects the cardinal fact that the prior art included the 401 machine (discussed supra), not merely the earlier patents assessed in the majority opinion. The 401 machine directly involved PTFE itself, not conventional thermoplastic polymers. That machine also directly involved rapid stretching of PTFE at a rate markedly exceeding 10%. With this prior art of the 401 machine before him, an ordinary person skilled in the art would maximize stretch rate, if only to improve the machine's production rate. Cf. *In re Dwyer, Jewell, Johnson, McGrath, & Rubin*, 317 F.2d 203, 207, 137 USPQ 540 (CCPA 1963). Moreover, the very existence and operation of the 401 machine, which stretched PTFE rapidly without breaking, suggests to the skilled person the probability of stretching at even higher rates. Certainly, in the light of the 401 machine, skilled workers would see in at least

⁸ An invention is anticipated if it "was known or used by others in this country *** before the invention thereof by the applicant for patent" (emphasis added).

⁹ It is undisputed that it was Wilbert Gore who initiated the project for the 401 machine and watched over it.

¹⁰ The majority's discussion of "secondary considerations," though it is relevant to other aspects of this case, is irrelevant to the issue of anticipation raised by the 401 machine, and hardly persuasive as to the issues of obviousness based on or with respect to the 401 machine.

the prior Markwood, Nash, and Scarlett patents (teaching extensive and rapid stretching of non-PTFE thermoplastics) the suggestion that the method of the 401 machine could also be used for comparable rapid and extensive stretching of PTFE.

6. In sum, I cannot escape the conclusion that--although there was no fraud proved--if the true facts as to the 401 machine had been made known to the PTO (as it requested), the involved claims of the '566 patent should (and probably would) not have been accepted.

Court of Appeals, Second Circuit

Harper & Row, Publishers, Inc. et al.
v. Nation Enterprises et al.

Nos. 83-7277 and 83-7327

Decided Nov. 17, 1983

COPYRIGHTS

1. In general (§24.01)

Copyright Act sets out test for preemption of state statutory or common law that may conflict with federal policies embodied in Act.

2. Matter copyrightable — Classes in statute (§24.303)

Work of authorship in which rights are claimed must fall within "subject matter of copyright" as defined in Copyright Act Sections 102 and 103; Act embraces "works of authorship," including "literary works," as within its subject matter.

3. Matter copyrightable — In general (§24.301)

Fact that portions of memoirs may consist of uncopyrightable material does not take work as whole outside subject matter protected by Copyright Act; were this not so, states would be free to expand perimeters of copyright protection to their own liking, on theory that preemption would be no bar to state protection of material not meeting federal statutory standards; that interpretation would run directly afoul of one of Act's central purposes, to avoid development of any vague borderline areas between state and federal protection.

4. In general (§24.01)

Copyright Act requires that state law create legal or equitable rights that are equiv-

alent to any of exclusive rights within general scope of copyright as specified in Section 106 if it is to be preempted; these include rights to reproduce copyrighted work in copies, and to prepare derivative works based upon copyrighted work; when right defined by state law may be abridged by act that, in and of itself, would infringe one of exclusive rights, state law in question must be deemed preempted; conversely, when state law violation is predicated upon act incorporating elements beyond mere reproduction or the like, rights involved are not equivalent, and preemption will not occur.

5. Rights embraced in copyright (§24.50)

There is no qualitative difference between right of author and his licensed publishers to exercise and enjoy benefit of pre-book publication serialization rights, and exclusive right under Copyright Act of preparing derivative works based on copyrighted work; enjoyment of benefits from derivative use is so intimately bound up with right itself it could not possibly be deemed separate element.

6. In general (§24.01)

Fact that plaintiffs pleaded additional elements of awareness and intentional interference, not part of copyright infringement claim, in support of state law claim, goes merely to scope of right; it does not establish qualitatively different conduct on part of infringing party, nor fundamental non-equivalence between state and federal rights implicated.

7. Matter copyrightable — In general (§24.301)

Copyright Act protects only original works of authors; it grants rights not in ideas or facts, but in expression; one reasonable interpretation of word "discovery" in statute is "fact"; for example, historian who learns in his research that certain event has occurred has discovered fact; copyright does not preclude others from using ideas or information revealed by author's work; Act is thus able to protect authors without impeding public's access to information that gives meaning to our society's highly valued freedom of expression; neither news events, historical facts, nor facts of biographical nature are deserving of Act's protection; listing of names, nouns, or information is indisputably copyrightable as compilation, but preexisting facts contained in those lists are not protected.

8. Matter copyrightable — In general (§24.301)

Distinction between fact and expression is not always easy to draw; author's originality

tion Ball may result in irreparable harm for purposes of entitlement to a Preliminary Injunction. The potential harm to the apparent infringer, the Defendants, does not weigh against the granting of injunctive relief. Further, the public interest is served by a Preliminary Injunction that prevents consumer confusion. By promoting a concert in Ohio using Moondog Coronation Ball, the Defendants have used Plaintiff's service mark without Plaintiff's permission in a way that is infringing Plaintiff's rights in the service mark. Therefore, OmniAmerica is entitled to a Preliminary Injunction.

IT IS THEREFORE ORDERED that the Defendants Street Gold Records, Ltd. dba Canterbury Productions/Farag Music BMI, the Moondog Coronation Ball Corp., and Independent Group Limited Partnership, their agents, and any other persons associated with or acting in concert with them, including but not limited to, Henry Farag and Canterbury Productions, Inc., be and hereby are restrained and enjoined from using the service mark "Moondog Coronation Ball" or any similar service mark in connection with any concert or other event. Use of a Mark that includes the words "Moondog" and "Coronation" in connection with a concert or other event will be considered to be use of a similar mark.

Specifically, Defendants, their agents, and any other persons associated with or acting in concert with them, including, but not limited to Mr. Henry Farag, Mr. Omar Farag, and Canterbury Productions, Inc. are enjoined from:

- 1) selling, issuing, or releasing any tickets bearing the service mark Moondog Coronation Ball or any similar mark;
- 2) issuing any written or oral promotion of the concert scheduled for March 23, 1996, or any other concert or event produced by Defendants, using the service mark Moondog Coronation Ball or any similar service mark;
- 3) making any representations that the concert scheduled for March 23, 1996, or any other concert or event produced by Defendants, is the Moondog Coronation Ball.

CONCLUSION

Based upon the forgoing reasons, Plaintiff, OmniAmerica's Motion for a Preliminary Injunction is GRANTED. All matters pertaining to damages, and any issues relating to the expiration of the service mark that expires on March 10, 1996, will be addressed at the Permanent Injunction Hearing which

will be held at a later date to be determined by this Court.

IT IS SO ORDERED.

U.S. Court of Appeals Federal Circuit

Senonics Inc. v. Aerosonic Corp.

Nos. 95-1058, -1062, -1098

Decided April 24, 1996

PATENTS

1. Patentability/Validity — Obviousness — Combining references (§115.0905)

Claimed vibrator for aircraft instruments is not obvious in view of prior art references considered alone or in combination, since there is no teaching or suggestion whereby person of ordinary skill in art would have been led to select particular mechanical and electrical structures and concepts and combine them as did inventor, and since drawing on hindsight knowledge of patented invention, when prior art does not contain or suggest that knowledge, is improper use of invention as template for its own reconstruction.

2. Infringement — Defenses — Fraud or unclean hands (§120.1111)

Failure to disclose inventor's prior patent during prosecution of patent in suit did not constitute inequitable conduct, since defendant's failure to mention prior patent in its request for re-examination of patent in suit weighs heavily against its contention that prior patent was material prior art, and since there is no evidence of culpable intent.

3. Infringement — Willful (§120.16)

Federal district court did not clearly err by concluding that defendants did not willfully infringe vibrator patent in suit, even though opinion of defendants' counsel does not mention defendants' copying and other objective indicia of unobviousness, and infringement continued even after validity of patent was confirmed on re-examination, since issue of willfulness raises questions of credibility as well as weight, and findings thereon are not readily reversed, and since infringement occurred four months prior to patent's expiration.

REMEDIES

4. Monetary — Damages — Patents —
Lost profits (§510.0507.05)

Infringement defendant's failure to retain production records during litigation gives rise to strong inference that such records would have been unfavorable to defendant, since it is not necessary to establish bad faith in order to draw adverse inference from "purposeful" action, and since it is appropriate that doubt be resolved against defendant in view of clear duty to keep and preserve records of acts for which infringement had been charged; federal district court's determination that 7,347 infringing units had been produced by defendant, based on extrapolation from production records available for final six months of patent's term, represents best available reconstruction of infringing activity, but court's reduction of extrapolated production by 33 percent to account for device repair or inefficiency in production is not supported by evidence.

5. Monetary — Damages — Patents — Increased damages (§510.0507.07)

Federal district court did not abuse its discretion by declining to award enhanced damages for patent infringement, since enhanced damages are punitive rather than compensatory, and depend on showing of willful infringement or other indicium of bad faith warranting punitive damages, and since court's finding that infringement was not willful was not clear error.

6. Monetary — Damages — Prejudgment interest (§510.0511)

Prejudgment interest in patent cases is withheld only under exceptional circumstances, and denial of such award based on calculation difficulties alone is error; prejudgment interest award is therefore warranted in present patent action in which there is no circumstance that would make such award unfair or inappropriate.

7. Monetary — Attorneys' fees; costs — Patents — Exceptional case (§510.0905.03)

Bad faith and willful infringement are not only criteria whereby case may be deemed "exceptional," since litigation misconduct and unprofessional behavior are relevant to award of attorneys' fees; remand of present case for determination of whether there was bad faith or vexatious behavior is therefore warranted, even though federal district court did not err in concluding that defendants did not willfully infringe.

PATENTS

8. Infringement — Inducement (§120.15)

REMEDIES

Monetary — Damages — Personal liability of corporate officials (§510.0513)

Federal district court properly concluded that individual defendant who was founder, owner, president, chief executive officer, and chief of engineering of infringing corporation is liable for inducement to infringe, and is jointly and severally liable for amount of judgment, since weight of evidence is strongly contrary to defendant's testimony that he was without authority to control or discontinue production of infringing device after becoming aware of plaintiff's patent rights, and since court therefore did not clearly err in determining that testimony was not credible.

Particular patents — Electrical — Tapping device

3,863,114, DeMayo, tapping device for generating periodic mechanical impulses, ruling that patent is enforceable, not invalid, and infringing is affirmed.

Appeal from the U.S. District Court for the Middle District of Florida, Merhige, J.

Action by Sensonics Inc. against Aerosonic Corp. and Herbert J. Frank for patent infringement. From ruling that patent claims are enforceable, not invalid, and infringed, and that defendant Herbert J. Frank is personally liable for inducing infringement, defendants appeal. Plaintiff cross-appeals measure of damages and denial of enhanced damages and attorneys' fees. Affirmed in part, modified and reversed in part, and remanded.

Daniel P. Burke, of Galgano & Burke, Hauppauge, N.Y., for plaintiff/cross-appellant.

Robert E. Greenstien, of Honigman, Miller, Schwartz & Cohn, West Palm Beach, Fla.; Anne E. Brookes, John T. Klug, Louis K. Bonham, and John G. Flaim, of Honigman, Miller, Schwartz & Cohn, Houston, Texas; Robert W. Boos and Kevin M. Gilhool, of Honigman, Miller, Schwartz & Cohn, Tampa, Fla., for defendant-appellant Aerosonic Corp.

Sybil Meloy, Lisa S. Mankofsky, and Patricia D. Granados, of Foley & Lardner, Washington, D.C., for defendant-appellant Herbert J. Frank.

Before Newman, circuit judge, Bennett, senior circuit judge, and Bryson, circuit judge.

Newman, J.

This consolidated appeal and cross-appeal concern United States Patent No. 3,863,114 (the '114 patent) owned by Sensonics, Inc. The defendants, Aerosonic Corp. and Herbert J. Frank, each appeals certain aspects of the judgment of the United States District Court for the Middle District of Florida.¹ Aerosonic appeals the district court's ruling that the '114 patent is valid and enforceable, and also appeals the ruling of infringement as to some of the patent claims but not as to others. Mr. Frank appeals the ruling that he is personally liable for inducement to infringe the Sensonics patent. Sensonics cross-appeals the measure of damages, and the court's denial of enhanced damages and attorney fees.

THE PATENTED INVENTION

The '114 patent is for a "Tapping Device for Generating Periodic Mechanical Pulses," inventor John F. DeMayo. Mr. DeMayo is a founder and officer of Sensonics. The tapping device, also called a "vibrator," is used primarily with aircraft instruments having moving indicators. Mechanical pulses, that is, taps, gently vibrate the moving parts in order to free them of the effects of static friction, permitting the indicator to move freely and thus with greater accuracy and reliability. Such devices require accurate and reliable operation for extended periods of time and over wide temperature and voltage ranges. They require careful control of the strength of the vibration pulses in order to avoid causing errors in or requiring recalibration of the aircraft instrument.

The invention claimed in the '114 patent is an electromagnetic vibrator that is easier to manufacture, more accurate, easier to adjust, and less expensive than prior devices. Its structure of a unitary base with integrally formed anvil and armature support eliminated the welding and soldering steps of earlier devices, and also assured a true and consistent path for the magnetic flux. Another advantageous structural component is the adjustment element for the strength of the vibration pulses, in the form of a screw which extends through the armature to the magnetic core. The head of the screw provides the stop for the moving armature, and thus adjustment of the screw enables ready adjust-

ment of the mechanical pulses without removing the device from its casing, a disadvantage of prior vibrators.

It was not disputed that Aerosonic copied the Sensonics device in complete detail, and replaced the vibrating-reed design of the vibrator that Aerosonic was then making commercially. Mr. Frank and other witnesses testified that the vibrating-reed design was hard to manufacture, had an unacceptably high failure rate after installation, and was deficient in that it did not allow adjustment of the strength of the mechanical pulses. The superiority of the Sensonics device in accuracy, reliability, and cost, was undisputed.

PATENT VALIDITY

Aerosonic raised the defense of patent invalidity based on obviousness in terms of 35 U.S.C. § 103. The principal prior art at trial was an earlier invention of Mr. DeMayo, described in United States Patent No. 3,507,339 (the '339 patent). This patent was not cited as a reference during prosecution of the application that led to the '114 patent.

Mr. DeMayo testified that the '339 patent represented an earlier effort to make an improved mechanical vibrator. There was evidence that the '339 design had some advantages over prior devices, but that its shortcomings included manufacturing complexity, increased size, multiple components, difficulty of assembly, difficulty of adjustment, and too high a failure rate. Mr. DeMayo testified that he continued to work to solve these problems, and that after several additional years of effort he succeeded in doing so, with the vibrator that became the subject of the '114 patent. Although the '114 design and the '339 design have several similarities, there was evidence that the changes embodied in the '114 device achieved the simplicity and efficiency of manufacture, easy and accurate adjustment, compactness, quietness in operation, and reliability, that were inadequate in the '339 device.

The '339 device has a screw extending through the armature to the magnetic core. This screw is soldered into place in order to provide sufficient contact within the device to ensure magnetic flux, and is not usable to adjust the strength of the pulses. Although at trial Aerosonic argued that it was obvious to make the design change of an adjustable screw, the district court observed that this element of the '114 invention provided significant advantages and remedied deficiencies of prior devices. The pulse strength for the '339 device was only adjustable from below, and thus was not readily adjusted

¹ *Sensonics, Inc. v. Aerosonic Corp.*, Nos. 90-84-T-23A and 93-724-T-23A (M.D. Fla. Oct. 11 and Nov. 4, 1994).

after installation. In contrast, the '114 device could be readily adjusted not only during manufacture but also after assembly and after installation in the aircraft instrument. Although Aerosonic points to the simplicity of this adjustment mechanism, simplicity does not establish obviousness; indeed, simplicity may represent a significant and unobvious advance over the complexity of prior devices.

The district court referred to the factual underpinnings of the determination of obviousness as set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966). Applying these criteria, the court discussed the testimony of Aerosonic's expert witness concerning the prior art. In addition to the '339 patent, the references relied on by Aerosonic were two patents on "telegraph-sounders" that were designed to make noise, a patent on a magnetically operated switch designed to absorb any shock created by contact of its armature and magnetic core, a patent on a relay for telephone lines to control secondary signals, and a patent for an automobile voltage regulator.

[1] The district court concluded that "[c]onsidered in their entirety, the references discussed by defendants' expert do not, in the court's view, lead one of ordinary skill in the art to the invention in suit." We agree that the references, alone or in combination, do not make obvious the '114 invention. There is no teaching or suggestion whereby a person of ordinary skill would have been led to select these mechanical and electrical structures and concepts and combine them as did DeMayo in the '114 invention. To draw on hindsight knowledge of the patented invention, when the prior art does not contain or suggest that knowledge, is to use the invention as a template for its own reconstruction — an illogical and inappropriate process by which to determine patentability. *W.L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983). The invention must be viewed not after the blueprint has been drawn by the inventor, but as it would have been perceived in the state of the art that existed at the time the invention was made. *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1138, 227 USPQ 543, 547 (Fed. Cir. 1985).

The DeMayo '114 device was placed in commercial production by Sensonics. Aerosonic purchased fifty of the Sensonics vibrators from Budd Electronics Corp. An Aerosonic engineer testified that he was instructed by Mr. Frank to copy every detail of the Sensonics device, mentioning the number of turns of wire in the electromagnet and

the wire thickness, the tension of the spring, the posts supporting the armature, the unitary construction, the adjustable screw, etc. Mr. Frank and other employees of Aerosonic testified that there were no acceptable substitutes in the industry for the DeMayo '114 vibrator design.

Patent invalidity must be proved by clear and convincing evidence. The differences from the prior art that were shown at trial, the inadequacies of prior vibrators including DeMayo's earlier '339 design, and the technological advantages and commercial success of the '114 invention, well support the district court's conclusion that invalidity based on obviousness had not been proved. The decision that the patent is valid is affirmed.

PATENT ENFORCEABILITY

Aerosonic charged Sensonics with inequitable conduct before the Patent and Trademark Office because Sensonics did not bring to the attention of the patent examiner the DeMayo '339 patent. The district court held that the intent element of inequitable conduct had not been shown, and referred to the evidence presented at trial of Sensonics' good faith. The court also observed that Aerosonic's own patent counsel did not initially notice the relevance of the '339 patent, and that the '339 patent was not cited by Aerosonic in its reexamination request which was made during the litigation, and for which the litigation was stayed.

The district court found that Mr. DeMayo, who testified at trial, was not aware of a need to direct the examiner to the '339 patent. Mr. DeMayo also testified that he did not believe that the '339 patent was relevant to the '114 invention due to the differences and significant drawbacks in the '339 design; this testimony was supported by other evidence of the differences and drawbacks of the '339 and other prior devices.

[2] Aerosonic presses the argument that Sensonics did not seek reexamination of the '114 patent in light of the '339 patent until after expiration of the '114 patent. The '114 patent expired during the litigation. The district court observed that Aerosonic had earlier requested reexamination of the '114 patent, but that Aerosonic did not mention the '339 patent in its reexamination papers. Indeed, Aerosonic's omission of the '339 patent from its reexamination request weighs heavily against its argument that the '339 patent was material prior art.

The burden of proof of inequitable conduct was upon Aerosonic. The factual predicates of both (1) a withholding of material

prior art and (2) the intent thereby to deceive or mislead the patent examiner into allowing the claims, must be shown by clear and convincing evidence. *Kingsdown Medical Consultants, Ltd. v. Hollister*, 863 F.2d 867, 872, 9 USPQ2d 1384, 1389 (Fed. Cir. 1988), cert. denied, 490 U.S. 1067 (1989). There was no evidence of culpable intent. The totality of the evidence, including the evidence of good faith, well supports the district court's finding that intent to deceive or mislead the examiner was not shown.

Absent reversible error in the district court's findings and conclusion, we affirm the decision that there was not inequitable conduct before the patent office and that the '114 patent is enforceable.

WILLFUL INFRINGEMENT

Aerosonic stipulated that it infringed claims 2 and 7. The district court found that Aerosonic also infringed claims 3, 8 and 11. Aerosonic appeals this latter finding, advising that we need not reach claims 3, 8, and 11 should we sustain the validity of claims 2 or 7. Thus the only infringement issue is Sensonics's cross-appeal of the district court's finding that Aerosonic's infringement was not willful.

Sensonics states that the court clearly erred in failing to find that the infringement was willful, referring to Aerosonic's deliberate and meticulous copying of the Sensonics device, and Aerosonic's delay of eight months before consulting patent counsel after it received written notice of infringement, as evidence that Aerosonic willfully disregarded or did not intend to respect the law. The devices that Aerosonic purchased from Budd Electronics and copied were all labelled with Sensonics' name. Sensonics states that the opinion of counsel that Aerosonic produced at trial was "protective" and was not a complete analysis, and that Aerosonic's continuing infringement after actual notice of Sensonics' patent was with knowledge and disregard of Sensonics' legal rights. Indeed, the opinion of counsel makes no mention of Aerosonic's copying and other objective indicia of unobviousness, although precedent requires that these factors be considered. See *Stratoflex v. Aeroquip Corp.*, 713 F.2d 1530, 1539, 216 USPQ 871, 879 (Fed. Cir. 1983) (evidence of objective considerations must always be taken into account).

[3] Although the opinion of Aerosonic's counsel is flawed, the issue of willfulness raises questions of credibility as well as weight, and findings thereon are not readily

reversed. See *King Instrument Corp. v. Otari Corp.*, 767 F.2d 853, 867, 226 USPQ 402, 412 (Fed. Cir. 1985) (giving due deference to the trier's right to determine credibility and weight). The district court found that Aerosonic timely retained patent counsel and reasonably relied on counsel's opinion. Although it is relevant that the infringement was continued even after the '114 patent was confirmed on reexamination, this occurred four months before patent expiration, and Sensonics does not argue that this event of itself signals willful infringement. On the whole we do not discern clear error in the district court's findings and conclusion on the issue of willful infringement.

DAMAGES

Sensonics appeals the district court's measure of damages, on the ground that the district court incorrectly assessed the number of infringing devices made by Aerosonic.

The criteria for lost profits damages that are summarized in *Panduit Corp. v. Stahl Bros. Fiber Works, Inc.*, 575 F.2d 1152, 197 USPQ 726 (6th Cir. 1978), were applied by the district court. The court found that Sensonics had proved (1) demand for the patented product, (2) Sensonics' ability to meet that demand, (3) the absence of acceptable non-infringing substitutes, and (4) the amount of lost profits per unit. The principal issue at trial was not any of these criteria, but the total number of devices that were made by Aerosonic during the period between actual notice of infringement on September 14, 1989 and the expiration of the '114 patent on January 28, 1992.

This issue arose because Aerosonic had apparently destroyed its manufacturing records after this litigation began. No manufacturing records were available for the relevant period except for a handwritten log book of serial numbers that covered the final six months preceding the expiration of the patent. This log commenced with number 21,267 in July 1991, after this suit had been pending for a year. It was the only remaining evidence of the number of devices manufactured. Aerosonic argues that the burden of proof of damages is upon the patentee, and that since the number of devices manufactured could not be proved, the burden could not be met.

However, if actual damages can not be ascertained with precision because the evidence available from the infringer is inadequate, damages may be estimated on the best available evidence, taking cognizance of the reason for the inadequacy of proof and

resolving doubt against the infringer. See *Westinghouse Elec. & Mfg. Co.*, 225 U.S. 604, 620 (1912) (infringer bears the risk when precise calculation is not possible); *Kort Corp. v. Wilco Marsh Buggies and Draglines, Inc.*, 761 F.2d 649, 655, 225 USPQ 985, 989 (Fed. Cir.) ("Fundamental principles of justice require us to throw any risk of uncertainty upon the wrongdoer rather than upon the injured party.") (citing *Story Parchment Co. v. Paterson Parchment Co.*, 282 U.S. 555, 563 (1931)), *cert. denied*, 474 U.S. 902 (1985).

When the calculation of damages is impeded by incomplete records of the infringer, adverse inferences are appropriately drawn. See *Lam, Inc. v. Johns-Manville Corp.*, 718 F.2d 1056, 1065, 219 USPQ 670, 675 (Fed. Cir. 1983) (any adverse consequences rest upon the infringer when inability to ascertain lost profits is due to the infringer's failure to keep accurate or complete records). When manufacturing records were destroyed after the litigation commenced, strong inferences adverse to the infringer may be drawn. *Beatrice Foods Co. v. New England Printing and Lithographing Co.*, 899 F.2d 1171, 1176, 14 USPQ2d 1020, 1024 (Fed. Cir. 1990).

The district court found that the final six months' log was the only evidence of the number of devices manufactured. The log listed 1,037 vibrators to which serial numbers were given during the final six months of the life of the '114 patent. From this number the district court extrapolated back, assuming an equal rate of production over the previous three years, to a total of 7,347 units manufactured between the date notice of infringement was given to Aerosonic and the date of patent expiration. See *Beatrice Foods*, 899 F.2d at 1176, 14 USPQ2d at 1024 (damages appropriately measured by reconstruction when infringer had destroyed its invoices). Sensonics states that this extrapolation gives an unrealistically low figure because Aerosonic would reasonably be expected to have cut back on infringing production for the last few months of patent life, especially because this litigation was ongoing.

[4] Sensonics states that Aerosonic's failure to retain production records during the litigation period requires that strong adverse inferences be drawn. We agree that this circumstance gives rise to a strong inference that the records would have been unfavorable to Aerosonic. *Lam v. Johns-Manville*, 718 F.2d at 1065, 219 USPQ at 675. Indeed, as the court discussed in *Nation-Wide Check Corp. v. Forest Hills Distribs., Inc.*, 692 F.2d 214, 218 (1st Cir. 1982), it is not

necessary to establish bad faith in order to draw an adverse inference from "purposeful" action:

The adverse inference is based on two rationales, one evidentiary and one not. The evidentiary rationale is nothing more than the common sense observation that a party who has notice that a document is relevant to litigation and who proceeds to destroy the document is more likely to have been threatened by the document than is a party in the same position who does not destroy the document. . . .

The other rationale for the inference has to do with its prophylactic and punitive effects. Allowing the trier of fact to draw the inference presumably deters parties from destroying relevant evidence before it can be introduced at trial.

citing 2 *Wigmore on Evidence* § 291, at 228 (Chadbourn rev. 1979).

Aerosonic had the clear duty of keeping and preserving records of the acts for which infringement had been charged, and it is appropriate that doubt be resolved against Aerosonic. Although Aerosonic's actions warrant adverse inferences, Sensonics does not suggest an alternative to the extrapolation method adopted by the district court. Thus the district court's extrapolation represents the best available reconstruction of the infringing activity, and is sustained.

The district court then reduced the extrapolated production of 7,347 units by 33% "in order to account for any duplication resulting from device repair or inefficiency in production of the vibrators." Sensonics states that this reduction is unsupported by evidence, and contrary to the great weight of the evidence. We must agree. There was no evidence that device repair or production inefficiency was reflected in the log showing the serial number that was applied when the vibrator was ready for shipment or installation. Mr. Frank, who was the chief executive officer of Aerosonic during this period, testified that: "The serial number is put on the vibrator just before it is shipped, or before we put it into an indicator." On this procedure, any device repair or inefficiency in production would not be reflected in the serial number.

The Aerosonic log that was produced included repairs. It was the only record of repairs that was produced, and showed a repair rate of less than 0.4%, without a change of serial number for the repaired unit. Aerosonic did not establish that 33% or any other number of vibrators bore multiple serial numbers or were given new serial numbers after they were returned for repair. Further, if evidentiary imprecision is due to

inadequacy of the infringer's records, uncertainty is resolved against the wrongdoer. *Kori v. Wilco*, 761 F.2d at 655, 225 USPQ at 989; *Lam v. Johns-Manville*, 718 F.2d at 1065, 219 USPQ at 675.

Aerosonic states that damages are measured not by the number of devices manufactured but by the number of devices sold before patent expiration, arguing that there is no record evidence of when the devices listed on the serial number log were sold, but that they would have been sold mostly after patent expiration. The statement of law is incorrect. The patent statute grants the patentee the right to exclude others from making, using, or selling the patented subject matter. 35 U.S.C. § 271. Any of these activities during the patent term is an infringement of the patent right.

In the absence of any evidence that a significant number of the units to which a serial number was given were not separate manufactures, the district court's reduction of the total of 7,347 is clearly in error, and is reversed. Damages shall be paid on 7,347 units. The district court's decision is modified accordingly.

ENHANCEMENT OF DAMAGES

Sensonics states that the district court abused its discretion in declining to enhance damages in accordance with 35 U.S.C. § 284 ("the court may increase the damages up to three times the amount found or assessed"). The district court's decision with respect to the enhancement of damages will be sustained unless it was based on an incorrect conclusion of law, clearly erroneous findings of fact, or a clear error of judgment. *National Presto Industries, Inc. v. The West Bend Co.*, 76 F.3d 1185, 1193, 37 USPQ2d 1685, 1691 (Fed. Cir. 1996).

[5] Section 284 does not state the circumstances in which damages may be enhanced by the court. In *Yarway Corp. v. Eur-Control USA, Inc.*, 775 F.2d 268, 277, 227 USPQ 352, 358 (Fed. Cir. 1985) the court explained that "enhancement of damages must be premised on willful infringement or bad faith." See *Shatterproof Glass Corp. v. Libbey-Owens Ford Co.*, 758 F.2d 613, 628, 225 USPQ 634, 644 (Fed. Cir.), cert. dismissed, 474 U.S. 976 (1985) (absent willful infringement, enhanced damages are usually not warranted). As elaborated in *Beatrice Foods Co. v. New England Printing and Lithographing Co.*, 923 F.2d 1576, 1580, 17 USPQ2d 1553, 1556 (1991), enhanced damages are punitive, not compensatory. Enhancement is not a substitute for perceived

inadequacies in the calculation of actual damages, but depends on a showing of willful infringement or other indicium of bad faith warranting punitive damages.

The district court declined to enhance damages. Since we have affirmed the finding that the infringement was not willful, we conclude that the district court acted within its discretion in declining to enhance damages pursuant to § 284.

PREJUDGMENT INTEREST

[6] The district court denied prejudgment interest, referring to the difficulty of its calculation. It was established in *General Motors Corp. v. Devex Corp.*, 461 U.S. 648, 217 USPQ 1185 (1983) that prejudgment interest is the rule, not the exception. The Supreme Court explained that the denial of prejudgment interest simply creates an incentive to prolong litigation, and that prejudgment interest in patent cases is withheld only under exceptional circumstances. 461 U.S. at 656-57, 217 USPQ at 1189. In *Lumus Industries, Inc. v. D.M. & E. Corp.*, 862 F.2d 267, 274-75, 8 USPQ2d 1983, 1988 (Fed. Cir. 1988) the court held that "[t]o deny prejudgment interest based on calculation difficulties alone would be error."

We have been directed to no circumstance that would make it unfair or inappropriate to award prejudgment interest in this case. As stated in *General Motors v. Devex*, an award of prejudgment interest serves to make the patent owner whole, for damages properly include the foregone use of money of which the patentee was wrongly deprived. 461 U.S. at 655-56, 217 USPQ 1188. Sensonics has included in its appellate brief a reasonable methodology for calculation of prejudgment interest. Aerosonic has not challenged the rate or the arithmetic. The denial of prejudgment interest is reversed. On remand prejudgment interest, calculated in accordance with the Sensonics method, shall be awarded.

ATTORNEY FEES

The district court did not separate, in its analysis, the criteria for enhancement of damages and for the award of attorney fees. They are not necessarily the same, although the contributing factors often overlap.

[7] The award of attorney fees requires a threshold determination that this is an "exceptional case." 35 U.S.C. § 285. Bad faith and willful infringement are not the only criteria whereby a case may be deemed to be "exceptional," although when either is

present the requirement is more readily met. Litigation misconduct and unprofessional behavior are relevant to the award of attorney fees, and may suffice to make a case exceptional under § 285. *Spectra-Physics Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1537, 3 USPQ2d 1737, 1746 (Fed. Cir.), *cert. denied*, 484 U.S. 954 (1987). See *Kloster Speedsteel AB v. Crucible Inc.*, 793 F.2d 1565, 1580, 230 USPQ 81, 91 (Fed. Cir. 1986) (bad faith in pretrial and trial stages, by counsel or party, may render the case exceptional under § 285).

The district court had declined to enhance damages, on the ground that the infringement was not willful. However, the district court did not discuss whether there were actions of bad faith sufficient to meet the criterion of "exceptional case" and to warrant the award of attorney fees. Sensonics points to Aerosonic's pre-litigation false statement that it was not manufacturing the device but was simply reselling it, citing Mr. Frank's letter of September 21, 1989 to Sensonics' counsel.² Sensonics states that this led it to sue Budd Electronics Corporation in the Eastern District of Pennsylvania. At trial Mr. Frank admitted that he ordered the copying and manufacture of the Sensonics device.

At his deposition Aerosonic employee Ronald Miller was testifying to similar effect when Aerosonic's attorney McDonald passed him a note stating "DID NOT COPY" (plaintiff's exhibit 52). These procedures, of which Sensonics complains forcefully, demean the litigation process.

Sensonics also points to Aerosonic's motion to the district court filed October 22, 1991, opposing Sensonics motion of October 15, 1991 to lift the stay for reexamination, Aerosonic assuring the court that the reexamination certificate had not issued, when it had issued on September 24, 1991. Before this aspect was resolved another year passed, during which the patent expired.

Combined with these actions is the matter of manufacturing records. Aerosonic employees admitted that prior serial number logs existed as late as eighteen months after the suit was filed, although no witness could tell what became of these logs. Aerosonic employees testified that they did not know how many devices were manufactured, even

for purposes of warranty control. Employees in responsible management positions testified that they did not have any records or any idea of how many devices were manufactured. The Supervisor of the Electronics Department, who personally kept the final six-months' log of serial numbers, testified that a previous log must have existed when she started the remaining log with serial number 21,267, but that it no longer existed or could be produced. As we have discussed, there is an uncompromising duty to preserve relevant records, and particularly after litigation has begun.

It is the judicial duty to refuse to condone behavior that exceeds reasonable litigation tactics. The district court made no findings concerning whether Aerosonic's actions were taken in good faith. Indeed, the court may consider the litigation actions of both sides in connection with § 285. See *Beatrice Foods*, 923 F.2d at 1580, 17 USPQ2d at 1556 (requiring findings of fact on the issue of bad faith). We remand for determination of whether there was bad faith or vexatious behavior or other grounds for deeming this case exceptional in terms of 35 U.S.C. § 285. If so, the district court may determine whether the award of attorney fees is warranted.

APPEAL OF HERBERT J. FRANK

Mr. Frank was the founder, owner, president, chief executive officer, and chief of engineering of Aerosonic. In 1990 he became chairman, his son-in-law became president, and Mr. Frank continued as chief executive officer for an additional two years. The district court found Mr. Frank personally liable for inducement to infringe the '114 patent. Mr. Frank appeals.

The tort of "inducement" under 35 U.S.C. § 271(b), when applied to invoke personal liability, is premised on a concept of tortfeasance whereby persons in authority and control may in appropriate circumstances be deemed liable for wrongdoing, when inducing direct infringement by another. See *Water Technologies Corp. v. Calco, Ltd.*, 850 F.2d 660, 7 USPQ2d 1097 (Fed. Cir.) (finding liability for inducement based on specific circumstances of personal control of Calco's manufacture of the infringing products), *cert. denied*, 488 U.S. 968 (1988); *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1578-79, 1 USPQ2d 1081, 1090 (Fed. Cir. 1986) (corporate officers who actively aid and abet their corporation's infringement may be personally liable for inducing infringement).

² Mr. Frank, then president, chief executive officer, and chief of engineering at Aerosonic, wrote: "Aerosonic Corporation purchased the vibrators from another company, and if you have some legal action, it would be against them." [signed] "Herbert J. Frank, President".

[8] Mr. Frank testified that he did not have the authority to control or discontinue production of the device after he became aware of Sensonics' patent rights or as the litigation progressed. The district court did not believe this statement. We do not discern clear error in this credibility determination, for the weight of evidence was strongly contrary to this testimony. In the absence of reversible error, the district court's ruling that Mr. Frank is liable for inducement to infringe, and jointly and severally liable for the judgment, is affirmed.

Summary

The district court's rulings of validity, enforceability, and infringement of the '114 patent are affirmed. Damages shall be measured on the basis of 7,347 infringing units, without enhancement. The denial of prejudgment interest is reversed. On remand the damages award and interest shall be recalculated, and the district court shall make findings on the issue of whether this is an exceptional case for the purposes of 35 U.S.C. § 285.

On Mr. Frank's individual appeal, the district court's judgment is affirmed.

Costs to Sensonics.

AFFIRMED IN PART, MODIFIED AND REVERSED IN PART, AND REMANDED.

Patent and Trademark Office Trademark Trial and Appeal Board

In re Broadway Chicken Inc.

Serial No. 74/326,626

Decided March 26, 1996

Released April 4, 1996

TRADEMARKS AND UNFAIR TRADE PRACTICES

1. Practice and procedure in Patent and Trademark Office — Ex parte proceedings — In general (§325.0501)

JUDICIAL PRACTICE AND PROCEDURE

Procedure — Evidence — In general (§410.3701)

Evidence offered by applicant for registration of "Broadway Chicken" mark for restaurant services, which consists of telephone and business directory listings of restaurants

using term "Broadway" in name, is sufficient to establish prima facie that significant number of third parties use trade names or service marks containing term "Broadway" for restaurant services and for goods or services related thereto, since there is no bias in directories, which were not prepared for purposes of present case but are maintained on ongoing basis for general business use, since multiple sources of third-party use evidence corroborate each other, and since Trademark Trial and Appeal Board takes more permissive stance with respect to introduction of evidence in ex parte proceeding than in inter partes proceeding.

TRADEMARKS AND UNFAIR TRADE PRACTICES

2. Infringement; conflicts between marks — Likelihood of confusion — Evidence of — In general (§335.0303.01)

Evidence of widespread third-party use, in particular field, of marks containing certain shared term is competent to suggest that purchasers have been conditioned to look to other elements of marks as means of distinguishing source of goods or services in that field.

3. Infringement; conflicts between marks — Likelihood of confusion — Particular marks — Confusion not likely (§335.0304.05)

Confusion is not likely to result from contemporaneous use of applicant's "Broadway Chicken" mark and registered marks "Broadway Pizza" and "Broadway Bar & Pizza" in connection with restaurant services, since applicant's evidence of widespread third-party use of trade names and marks containing term "Broadway" for restaurant services, closely related goods and services, and unrelated goods and services, viewed together with differences in marks and geographic significance of term "Broadway," is sufficient in ex parte proceeding to warrant finding that confusion is not likely.

Appeal from final refusal of intent-to-use application for trademark registration (Zahleh S. Khabiri, examining attorney; R. Ellsworth Williams, managing attorney).

Application of Broadway Chicken Inc., no. 74/326,626, filed October 28, 1992, for registration of mark "Broadway Chicken," for restaurant services. From final refusal of registration, applicant appeals. Reversed.

Before Rice, Hanak, and Hohein, administrative trademark judges.